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CHANGE NOTICE INFORMATION

PRODUCT GROUP:	CHANGE CATEGORY:	EFFECTIVITY DATE:
AC Drives	RED FLAG 12 -MONTH NOTICE	July 15, 2004
MPG DRIV MPL EA4		FILE CONTROL NUMBER: RAL 03 0007

Description of Change:

The complete line of ALTIVAR 58 (ATV58) packaged drive controllers was launched in July of 2003. This includes Class 8839 58M Enclosed as well as Class 8998 MCC ATV58 Drive Controllers. With this recent launch and with other product upgrades, the ATV58 Drive Controller is now a functional replacement for the ALTIVAR 66 (ATV66) Drive Controller.

As a result, the ATV66 Drive Controller (Class 8839 Enclosed and Class 8998 MCC) will become obsolete and unavailable after July 15, 2004.

The entire ATV66 product line is affected, covering the following ranges:

1 - 50 HP @ 208/230V
1 - 400 HP @ 460V

Class 8839 Enclosed ATV66 Drive Controller

Objective of Change:

The objective of this change is to convert customers to our most current product available, the ATV58 family of AC drives. The ATV58 product line is a complete family of AC Drives, offering high-performance sensorless vector control, a physical size reduction from the ATV66 AC drive line, and a broad range of options including extensive serial communication capabilities. The ATV58 TRX AC Drive product is the functional replacement for the ATV66 AC Drive product line.

Class 8898 MCC ATV66 Drive Controller

Transition Tools:

Refer to the Class 8839 58M Enclosed Drive Product Launch Zone (July 2003) on Square D's Intranet for more information on the replacement product for the Class 8839 Enclosed ATV66 Drive Controller.
Refer to the Class 8998 Motor Control Center Altivar 58 TRX AC Drives Pricing Guide for more information on the replacement product for MCC ATV66 Drive Units.
Call Seneca Customer Support at 864-886-1400 (Enclosed) or 864-886-1633 (MCC) if you need assistance.

Date of New Product Availability:

Both Enclosed and MCC ATV58 Drive Controller products are available as of the June 2003 Quote To Cash Product Selector Synch.

Disposition of Obsolete Product:

During the transition period, we will supply the ATV66 AC Drive if required for existing customers with extended lead times. The ATV58 TRX AC Drive should be used for new applications and wherever possible.

Return Policy for Obsolete Product:

The return policy will be per Square D's latest published conditions of sale

Product Line Manager:	Location:	Product Line Director:	Date Issued:
Ruben VanderDuim (Enclosed) David Ray (MCC)	Raleigh, NC Seneca, SC	Geoff Walker Allen Breeze	July 2003

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CHANGE NOTICE INFORMATION

PRODUCT GROUP:		CHANGE CATEGORY:	EFFECTIVITY DATE:
AC Drives		RED FLAG 12 -MONTH NOTICE	July 15, 2004
MPG	DRIV		FILE CONTROL NUMBER:
MPL	EA2		RAL 03 0006

Description of Change:

With the completion of the upgrades to the ALTIVAR 58 TRX (ATV58 TRX) AC Drive product line, it is now a functional replacement for the ALTIVAR 66 (ATV66) AC Drive. The ATV66 AC Drive and all of its catalogued options will become obsolete and unavailable after July 15, 2004.

The entire ATV66 product line is affected, covering the following ranges:

1 - 50 HP @ 208/230V
1 - 400 HP @ 460V

ATV66 AC Drive

Objective of Change:

The objective of this change is to convert customers to our most current product available, the ATV58 TRX family of AC drives. The ATV58 TRX product line is a complete family of AC Drives, offering high-performance sensorless vector control, a physical size reduction from the ATV66 AC drive line, and a broad range of options including extensive serial communication capabilities. The ATV58 TRX AC Drive product is the functional replacement for the ATV66 AC Drive product line.

Transition Tools:

To determine which ATV58 TRX AC Drive to use during the conversion process, refer to the cross-reference chart on page 2.
Refer to the Product Launch Zone (October 2002) on Square D's Intranet for more information.
Call the Product Support Group at 919-266-8600 if you need assistance.

Date of New Product Availability:

The ATV58 TRX AC Drive Product has been available since October 2002.
A replacement model for every ATV66 AC Drive (including options) is now in stock in Mechanicsburg.

Disposition of Obsolete Product:

During the transition period, we will supply the ATV66 AC Drive as required. The ATV58 TRX AC Drive should be used for new applications and wherever possible.

Return Policy for Obsolete Product:

The return policy will be per Square D's latest published conditions of sale.
Any stock of products should be managed to minimize inventory through the transition.

Product Line Manager:	Location:	Product Line Director:	Date Issued:
Ruben VanderDuim	Raleigh, NC	Geoff Walker	July 2003

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ATV66 to ATV58 TRX AC Drive Cross Reference

ATV66 Model Number	Constant Torque Rating		Variable Torque Rating		Variable Torque Low-Noise Rating		ATV58 TRX Model Number [1]
	208/230V	460V	208/230V	460V	208/230V	460V	
ATV66U41M2U	1	—	1	—	1	—	ATV58HU18M2ZU
	2	—	2	—	2	—	ATV58HU29M2ZU
	3	—	3	—	3	—	ATV58HU41M2ZU
ATV66U72M2U	5	—	5	—	5	—	ATV58HU72M2ZU
	—	—	7.5	—	—	—	ATV58HU90M2ZU
ATV66U90M2U	7.5	—	—	—	7.5	—	
	—	—	10	—	—	—	ATV58HD12M2ZU
ATV66D12M2U	10	—	—	—	10	—	
	—	—	15	—	—	—	ATV58HD16M2XZU
ATV66D16M2U	15	—	—	—	15	—	
ATV66D23M2S264U	—	—	20	—	—	—	
	20	—	25	—	20	—	ATV58HD23M2XZU
ATV66D33M2U	25	—	30	—	25	—	ATV58HD28M2XZU
	30	—	40	—	30	—	ATV58HD33M2XZU
ATV66D46M2U	40	—	50	—	40	—	ATV58HD46M2XZU
ATV66U41N4U	—	1	—	1	—	1	ATV58HU18N4ZU
	—	2	—	2	—	2	ATV58HU29N4ZU
	—	3	—	3	—	3	ATV58HU41N4ZU
ATV66U54N4U	—	—	—	5	—	—	ATV58HU72N4XZU
ATV66U72N4U	—	—	—	—	—	5	ATV58HU54N4XZU
	—	5	—	—	—	—	ATV58HU72N4XZU
	—	—	—	7.5	—	—	ATV58HU90N4XZU
ATV66U90N4U	—	—	—	—	—	7.5	ATV58HU72N4XZU
	—	7.5	—	—	—	—	ATV58HU90N4XZU
	—	—	—	10	—	—	ATV58HD12N4XZU
ATV66D12N4U	—	—	—	—	—	10	ATV58HU90N4XZU
	—	10	—	—	—	—	ATV58HD12N4XZU
	—	—	—	15	—	—	ATV58HD16N4XZU
ATV66D16N4U	—	—	—	—	—	15	ATV58HD12N4XZU
	—	15	—	—	—	—	ATV58HD16N4XZU
	—	—	—	20	—	—	ATV58HD23N4XZU
ATV66D23N4U	—	—	—	—	—	20	ATV58HD16N4XZU
	—	20	—	—	—	—	ATV58HD23N4XZU
	—	—	—	25	—	—	ATV58HD28N4XZU
ATV66D33N4U	—	—	—	—	—	25	ATV58HD23N4XZU
	—	25	—	30	—	—	ATV58HD28N4XZU
	—	30	—	40	—	30	ATV58HD33N4XZU
ATV66D46N4U	—	40	—	50	—	40	ATV58HD46N4XZU
ATV66D54N4U	—	50	—	60	—	50	ATV58HD54N4XZU
ATV66D64N4U	—	60	—	75	—	60	ATV58HD64N4XZU
ATV66D79N4U	—	75	—	100	—	75	ATV58HD79N4XZU
ATV66C10N4U	—	100	—	—	—	—	ATV58HC13N4XZU [2]
ATV66C10N4U	—	—	—	125	—	—	ATV58HC10N4XZU
ATV66C10N4BU	—	100	—	—	—	—	ATV58HC13N4XZU [2] [3]
ATV66C13N4U	—	125	—	—	—	—	ATV58HC15N4XZU [2]
ATV66C13N4U	—	—	—	150	—	—	ATV58HC13N4XZU
ATV66C13N4BU	—	125	—	—	—	—	ATV58HC15N4XZU [2] [3]
ATV66C15N4U	—	150	—	—	—	—	ATV58HC19N4XZU [2]
ATV66C15N4U	—	—	—	200	—	—	ATV58HC15N4XZU
ATV66C15N4BU	—	150	—	—	—	—	ATV58HC19N4XZU [2] [3]
ATV66C19N4U	—	200	—	—	—	—	ATV58HC23N4XZU [2]
ATV66C19N4BU	—	200	—	—	—	—	ATV58HC23N4XZU [2] [3]
ATV66C23N4U	—	250	—	—	—	—	ATV58HC25N4XZU [2] [3]
ATV66C23N4U	—	—	—	250	—	—	ATV58HC19N4XZU [3]
ATV66C23N4U	—	—	—	300	—	—	ATV58HC23N4XZU [3]
ATV66C28N4U	—	300	—	—	—	—	ATV58HC31N4XZU [2] [3]
ATV66C28N4U	—	—	—	350	—	—	ATV58HC25N4XZU [3]
ATV66C31N4U	—	350	—	—	—	—	ATV58HC33N4XZU [2] [3]
ATV66C31N4U	—	—	—	400	—	—	ATV58HC28N4XZU [3]

[1] Every ATV66 AC drive is factory supplied with a keypad. The ATV58 AC drive is not. Order one ATV58 keypad (field installable kit number VW3A58101U) for every ATV58 AC drive for which a keypad is required. An optional I/O extension card may be needed to match specific ATV66 I/O capability. Consult the ATV58 catalog 8806CT9901 for details.
[2] Consult Instruction Bulletin VVDED397048US for details on operation below 6 Hz.
[3] An internal dynamic braking transistor is not available with the ATV58 AC drive at this HP rating.

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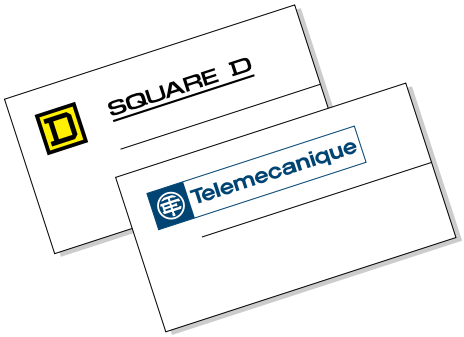
Obsolete-See ATV58 TRX

ALTIVAR® 66 AC Drives

Enclosed AC Drives
Motor Control Centers

Class 8800 / 8839 / 8998



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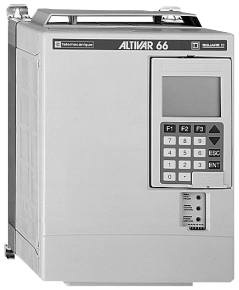

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Basic Drive

Introduction

The ALTIVAR 66 drive is designed for use with standard three-phase asynchronous motors with a power range of 1 to 350 hp (constant torque) or 400 hp (variable torque), 2.2 to 220 kw (constant torque) or 250 kw (variable torque). With its modular design and extensive range of options and accessories, the ALTIVAR 66 drive can be used in all types of industrial environments, commercial construction, and OEM applications.

Factory Setting

The ALTIVAR 66 drive is factory preset for use in most common applications.

Sensorless Flux Vector Control

The ALTIVAR 66 basic drive incorporates flux vector control without encoder feedback, giving rated motor torque at 0.5 Hz without adjustment.

Reduction of Motor Noise

For use with constant or variable torque, a high switching frequency (2 kHz, 4 kHz, or 10 kHz) is available.

Drive Operator Interface

A keypad display is mounted on front of the drive. It allows:

- Choice of six languages
- Drive identification, parameter and fault display
- Recall of adjustments and drive configuration
- Display of running values such as output frequency or a fault
- Local control of the drive

Protection

The drive automatically protects itself against short circuits:

- Between output phases
- Between output phases and ground
- On the outputs of internal supplies
- On the logic and analog outputs

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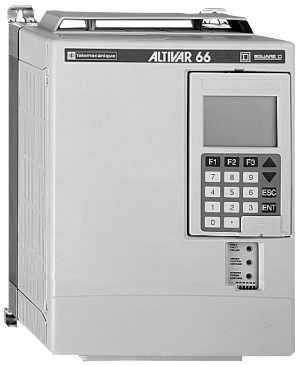
The ALTIVAR 66 drive benefits from a new concept, PRO System (Performance Regulation Optimization), providing a solution for demanding drive applications. Features include:

- New motor flux control algorithms
- Automatic adaptation of motor parameters
- Sensorless flux vector control without encoder
- Transient overtorque necessary for starting



- Maximum available torque at low speeds without adjustment
- Automatic adjustment of acceleration and deceleration ramp times when torque capabilities are exceeded

The drive can be configured for either constant or variable torque applications.

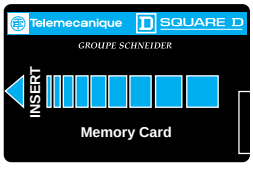
This sensorless flux vector control provides:

- Exceptional torque performance with a standard motor
- Rapid dynamic response with digital speed regulation
- Optimal performance for extruders, specialty machines, and material handling applications
- Economic solution for high torque and low speed

The switching frequency is randomly modulated to reduce audible motor noise while limiting losses in the drive.

The LCD graphic screen displays graphs and has reverse video for enhancing text or numerical values on the screen. An access locking switch on back of the keypad and a software key allow partial or total access to parameters. Adjustments can be saved on a PCMCIA card (Personal Computer Memory Card International Association) and subsequently downloaded into other ALTIVAR 66 drives. Three LEDs on front of the drive indicate status:

- Red LED illuminated: Drive fault
- Yellow LED illuminated: Current limit; flashing: Prealarm
- Green LED illuminated: Drive powered



The drive provides UL rated electronic motor thermal protection. The drive also provides:

- Thermal protection against excessive overheating
- Protection against input line supply undervoltage and overvoltage
- Protection against input and output phase loss

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Options

I/O Extension Modules

(Pages 35-39)

When the ALTIVAR 66 drive is first powered up, it is ready for use in its standard configuration for most applications. It is possible to add other functions by using an optional Input/Output Extension Module.

Communication

(Pages 40-45)

Designed to be integrated into modern automated architectures, the ALTIVAR 66 drive can be connected to several different multidrop communication buses.

Accessories

Dynamic Braking

(Pages 69-71)

A braking transistor is integrated into the ALTIVAR 66 drive.

PC Connection

The PC Connection option allows the drive to be connected to a personal computer via RS 232C.

Keypad Door Mounting Kit

(Page 62)

The keypad display can be remotely mounted with the use of a Keypad Door Mounting Kit.

Recess Mounting Kits

(Page 62)

The heat sink on the drive can be mounted through the enclosure wall.

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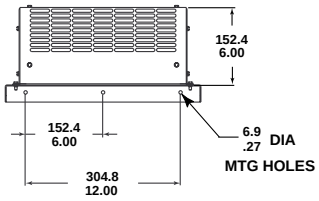
The I/O Extension Module adds additional logic and analog inputs and outputs. Two versions are available, for 24 VDC control and for 115 VAC control, allowing the drive to be adapted to your configuration.

Communication is possible with the most common industrial protocols:

- UNI-TELWAY
- MODBUS RTU / ASCII
- MODBUS Plus

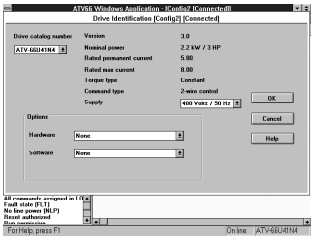
Other interfaces are available through third party offerings.

The addition of an external resistor permits dissipation of excess braking energy, allowing the drive to function in quadrants 2 and 4 of the speed/torque curve.



The software provides the following advantages:

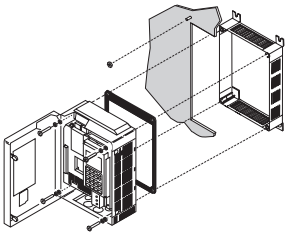
- Prepare a drive configuration without connecting the drive to the computer.
- Save configurations and adjustments on a floppy or hard disk.
- Download configuration and adjustments into the drive.
- Provide a printout of drive configuration for future reference.



The Keypad Door Mounting Kit allows the keypad to be mounted in the enclosure door. It allows you to view the display and access the keypad.The kit also allows three LEDs to be mounted in the enclosure door:

- Red LED illuminated: Drive fault
- Yellow LED illuminated: Current limit; flashing: Prealarm
- Green LED illuminated: Drive powered

The Recess Mounting Kit can be used with Type 1 or Type 12 enclosures. Use of these kits reduces heat dissipated in the enclosure, allowing a smaller enclosure to be used.



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Environment

Conformance to standards		NEMA, NEC, VDE and IEC Conforms to ISO 9001 standards
Product certification		UL Listed per UL 508C as incorporating electronic overload protection ATV66U41N4 to D79N4 and ATV66U41M2 to D46M2 — UL File E164874 CCN NMMS ATV66C10N4 to C31N41 and ATV66U41M2 to D46M2 — UL File E138755 CCN NMMS CSA certified ATV66U41N4 to D79N4 — CSA File LR96921 Class 3211-06 ATV66C10N4 to C31N41 — CSA File LR60905 Class 3211-06
Degree of protection		NEMA Type 1 (IP30)
Resistance to vibrations		Conforming to IEC 68-2-6: • ATV66U41N4 to D46N4 and ATN66U41M2 to D33M2: 1 mm peak to peak from 5 to 22.3 Hz and 2 g peak from 22.3 to 150 Hz • ATV66D54N4 to C31N41 and ATV66D46M2: 0.15 mm peak to peak from 10 to 58 Hz and 1 g peak from 58 to 150 Hz
Resistance to shock		Conforming to IEC 68-2-27: • 15 g peak for 11 ms
Maximum ambient pollution		Pollution degree 3 per NEMA ICS-111A or ICS-1, and IEC 664-1
Maximum relative humidity		95% without condensing or dripping water
Temperature		
Storage	°F (°C)	-13 to +158 (-25 to +70)
Operation	°F (°C)	+32 to +104 (0 to +40)
Maximum altitude	ft (m)	ATV66U41N4/M2 through ATV66C19N4 ≤ 3300 (1000); above this derate by 1.2% for every 300 (100); max. 6600 (2000). ATV66C23N41 through ATV66C31N41 ≤ 3300 (1000).
Mounting position		Vertical

Drive Characteristics

Output frequency range	Hz	0.1 to 400 Hz for ATV66U41N4 to D79 drives (constant torque configuration) 0.1 to 200 Hz for ATV66C10N4 to C31N41 drives (constant torque configuration) 0.1 to 75/90 Hz for ATV66U41N4 to C31N41 drives (variable torque configuration) 0.1 to 400 Hz for ATV66U41M2 to D46M2 drives (constant torque configuration) 0.1 to 75/90 Hz for ATV66U41M2 to D46M2 drives (variable torque configuration)
Speed range		1 to 100 (with constant torque)
Speed regulation		Volts/Hertz control type: determined by motor slip, 3% typical for NEMA B motor Normal or high torque (sensorless flux vector) control type: 1.0% without adjustments 0.5% with optional tachometer
Transient overtorque		150% of nominal motor torque (typical value ±20%) for 60 s (constant torque) 110% of nominal motor torque for 60 s (variable torque)
Maximum transient current		200% of nominal motor current for 0.2 s at starting for constant torque configuration 150% of nominal motor current for 60 s for constant torque configuration 110% of nominal motor current for 60 s for variable torque configuration
Switching Frequency		4 kHz ATV66U41N4 to ATV66D46N4 constant or variable torque rating 10 kHz ATV66U41N4 to ATV66D46N4 variable torque low noise rating 2 kHz ATV66D54N4 to ATV66D79N4 constant or variable torque rating 4 kHz ATV66D54N4 to ATV66D79N4 variable torque low noise rating 2 kHz ATVC10N4 to ATV66C31N4 constant or variable torque rating
Efficiency		94.5% to 97.87% (load dependent)
Displacement power factor		Approximately 0.96

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Electrical Characteristics

Input		
Voltage	V	200 ±10%, 230 ±15% 400 ±15%, 460 ±15%
Frequency	Hz	47.5 to 63
Output voltage		Maximum output line voltage is equal to input line voltage
Available control voltage		3 outputs: 0 V common for all supplies 1 output: +10 V for the reference potentiometer (1-10 kΩ),10 mA maximum flow 1 output: +24 V for control inputs, 210 mA maximum flow
Analog inputs AI Speed reference		1 analog voltage input AI1: 0-10 V, impedance 30 kΩ 1 analog current input AI2: 4-20 mA, impedance 250 Ω AI2 can be modified to 0-5 V with a switch located on the control board or reprogrammed from the keypad display for 0-20 mA, x-20 mA or 20-4 mA. Frequency resolution: 0.1 Hz at 60 Hz for analog reference Response time: 5 to 10 ms. AI1 and AI2 can be summed.
Frequency resolution for digital reference (serial link)		0.015 Hz at 60 Hz
Logic inputs LI		4 logic inputs. 10 ms sample time. +24 V at 10 mA (minimum 12 V, maximum 30 V) State 0 if < 5 V; state 1 if >12 V Factory preset assignments (LI3 and LI4 can be reassigned from the keypad display): LI1 = run enable LI2 = run forward LI3 = run reverse LI4 = jog
Analog outputs AO		2 analog outputs 0-20 mA (4-20 mA programmable) recommended load impedance 250 Ω Linearity: ± 0.1% maximum current Accuracy: ± 0.5% full scale Factory setting (AO1 and AO2 can be reassigned from the keypad display): AO1 = output frequency AO2 = output current
Logic outputs LO		2 logic outputs PLC-compatible, open-collector +24 V (minimum 12 V, maximum 30 V), maximum 200 mA Factory preset assignments (LO1 and LO2 can be reassigned from keypad display): LO1 = at speed LO2 = current limit attained
Relay outputs R		2 logic relay outputs 1 N.O. - 1 N.C. (contact protected against overvoltages by a varistor) Minimum: 10 mA at 24 VDC Maximum inductive load: 2 A at 120 VAC, 1 A at 220 VAC, 2 A at 24 VDC Factory setting (R2 can be reassigned from the keypad display): R1 = drive fault R2 = drive running
Acceleration and deceleration ramps		Factory preset to 3 s, linear ramp Separately adjustable from 0.1 to 999.9 s (0.1 s resolution) Ramp type: adjustable to linear, “S”, or “U” Ramp times automatically adjusted in case of overtorque
Braking to standstill		Automatic by DC injection for 0.5 s when frequency drops below 1.0 Hz Amount of current, frequency threshold and injection time are programmable from the keypad display
Dynamic braking		By optional resistor
Drive protection		Protection against short circuits • Between the output phases • Between output phases and ground • On outputs of internal supply • On the logic and analog outputs Thermal protection against excessive overheating Protection against input line supply undervoltage and overvoltage Protection against phase loss
Motor protection		Incorporated electronic thermal protection by I^2t calculation taking speed into account Storage of motor thermal state Phase loss protection Function programmable from the keypad display

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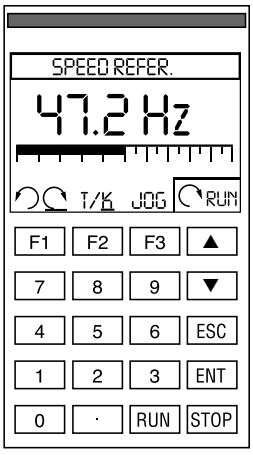
OVERVIEW

The ALTIVAR 66 drive uses the latest in AC drive technology. The ALTIVAR 66 is a sensorless flux vector drive. It has a six step diode front-end, and uses IGBT (insulated gate bi-polar transistors) to produce a PWM (pulse width modulated) output waveform to the motor. The product has an input power factor of near unity, and a typical efficiency of 96% operating under full load. The ALTIVAR 66 drive is configurable for constant torque or variable torque applications. In constant torque mode, an auto-tune feature creates a motor model to provide superior torque at low speed. The ALTIVAR 66 drive is capable of providing 100% of motor rated torque at 0.5 Hz, and 150% of motor rated torque at 1 Hz. In variable torque mode, the NOLD (No Load) feature (based on the NOLA principle) can be enabled to automatically optimize the volts/hertz pattern for a given load at a given speed. This increases efficiency of the system, and reduces audible motor noise. In addition, the switching frequency is randomly modulated to prevent a single tone pitch from developing at the motor. If needed, the variable torque low noise mode can be selected which increases the switching frequency to reduce audible motor noise.

DRIVE OPERATOR INTERFACE

The ALTIVAR 66 drive includes a keypad display mounted on the front of the drive. The keypad allows:

- Choice of language
- Drive identification
- Display of parameter values when drive is running, or of fault type when drive is in fault condition
- Adjustment and configuration of the drive
- Local command of the drive



Display

Liquid crystal display screen, 128 x 64 dot matrix:

- 6 lines of 21 characters
- Display of parameter values in bar graph form and configuration information and diagnostics
- Back lit for ease of viewing
- Reverse video for enhancement of text and numerical values

20-Key Keypad

- ENT (Enter) key: Confirms a typed value or advances to next menu
- ESC (Escape) key: Cancels an adjustment or returns to previous menu
- 2 direction keys ▲▼: Scroll up and down through menus, increase or decrease numeric parameters
- 11 number keys: Use to enter numerical values (0 to 9) and decimal point
- 3 assignable function keys: F1, F2, and F3 for programmable functions
- RUN key and STOP key: For local command of drive. Plastic cover is factory-installed; remove for access to keys.

Parameters are displayed in plain English, or one of five other languages, including German, Italian, Swedish, Spanish and French. There are no numerical codes.

The function keys are used to jump to a menu (F3) or display screen (F2), or to show a help screen (F1). When the keypad is used to run the drive, the function keys can be set for functions such as jogging, changing direction, or switching between terminal strip and keypad command. The "." key can be used to enter desired speed.

Hardware and software access locks provide three levels of access to menus:

- Total Lock
- Partial Unlock
- Total Unlock

Total Lock allows display of analog input and output and logic input and output status, as well as fault history. Partial Unlock also gives access to the drive configuration and parameters adjusted most often. Total Unlock allows adaptation of the drive to specific applications, configuration of the display screen, and local command from the keypad. When in Total Unlock, the drive can be tested using the diagnostic mode and the settings can be saved on a PCMCIA card to be downloaded into another drive.

The keypad display can be removed and used as a handheld terminal, using either an optional 3-meter cable or 2-meter cable. It can also be mounted in an enclosure door with a keypad door mounting kit. When mounted in an enclosure with the keypad door mounting kit, the keypad display has a Type 12 rating.

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START UP ASSISTANCE

The ALTIVAR 66 drives are factory set for:

- Constant torque applications
- 2-wire control

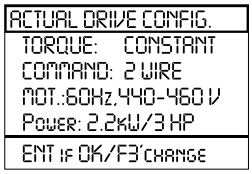
When the drive is powered up in constant torque configuration, the drive performs an autotune to maximize motor performance. Direct current equal to the AC drive rated current is injected into the motor, allowing the drive to determine the resistance of the motor and set the motor parameters.

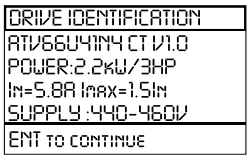
At first power up, the language menu is displayed. Once the language is selected, the display shows the actual drive configuration. On subsequent power ups, the display proceeds directly to the Drive Identification screen which shows the nameplate information: drive catalog number, constant torque or variable torque configuration, version of software, horsepower, and nominal and maximum drive current.

Upon first power-up, the AC drive senses the connected power system frequency. If this value is 50 Hz, Nominal Frequency is set to 50 Hz. If it is 60 Hz, Nominal Frequency is set to 60 Hz.

On 460 V units upon first power-up, if the input line is 50 Hz, the AC drive is configured for 400 V Nominal Voltage. If the input line is 60 Hz, the AC drive is configured for 460 V Nominal Voltage.

On 230 V units upon first power-up, the AC drive is configured for 230 V for 50 Hz and 60 Hz input lines.

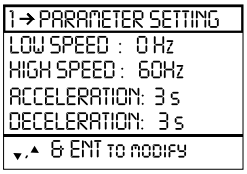




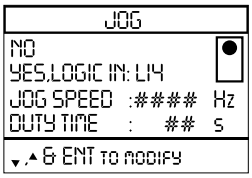
If the factory settings do not suit your application, you can change the parameter settings. First select the torque type: constant torque, variable torque, or variable torque low noise. Then set the type of command: 2-wire or 3-wire.

Motor parameters can be entered to match the motor nameplate information and slip compensation can be adjusted. Control parameters such as high and low speeds, acceleration and deceleration ramp times, ramp types, selection of alternate ramps, and skip frequencies can also be adjusted.

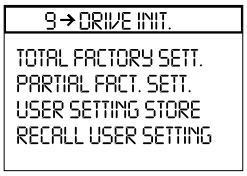
See pages 14-22 for drive configuration and adjustments.



Application functions are built into the drive. The ALTIVAR 66 drive can be configured for jogging, +speed/-speed, preset speeds, manual/auto switching, shutdown (stopping after dwelling at low speed), and bypass. Logic and analog inputs and outputs can be assigned to provide the needed information.



A Drive Initialization menu can be used to return to factory settings. This menu is also used to save the configuration and adjustments onto a PCMCIA card which can be used to download the settings into other drives of equal horsepower.

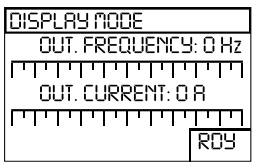


ASSISTANCE WHEN RUNNING

The large display screen makes it easy to check operating values while the drive is running.

Select from three ways to display operating values:

- 1 bar graph for reading the value at a distance
- 2 bar graphs (illustrated below)
- 4 tables in each mode contain a list of 14 operating values which can be successively displayed by pressing the arrow keys



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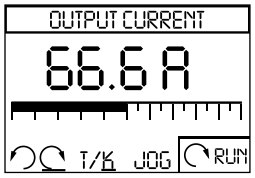
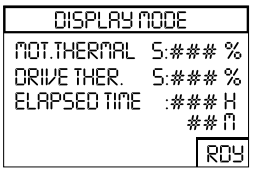
The 1 bar graph display is shown below. If keypad command mode has been selected, the assignment of the F1-F2-F3 function keys is shown on the screen, along with a status code such as RUN, RDY or ACC, indicating drive state.



Choose from 14 display values. Two of these can be user-defined application measurements such as number of products per minute in a material handling application. Other values include: output frequency, current, voltage, power, line voltage, DC voltage, motor and drive thermal state, speed reference, motor torque, PI setpoint, and PI feedback.

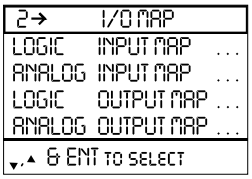


MAINTENANCE ASSISTANCE

The ALTIVAR 66 drive has several menus which aid in maintaining the drive.

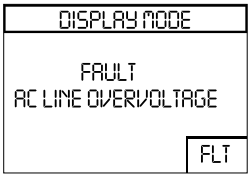
The following menus are accessible at all times:

- I/O Map: the assignment of the logic and analog inputs and outputs as well as their state or value is shown. This is a very useful diagnostics tool.



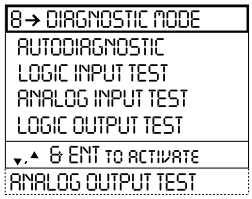
- Fault History: this menu allows the display of up to eight of the most recent faults.

If a fault occurs, the type of fault is displayed in the chosen language (code words are not used). Drive status at the time of the fault is also stored, indicating if the drive was accelerating, decelerating, or in the ready state when the fault occurred.



The Diagnostic Mode helps to determine the failed part in case of an internal fault:

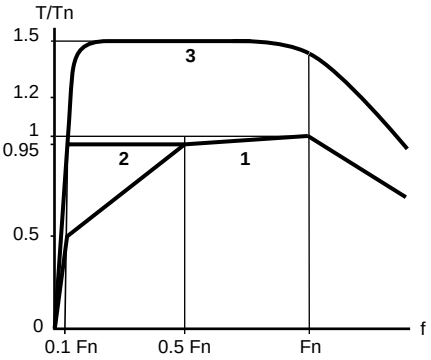
- Test of the inputs/outputs with forcing of the outputs
- Test of the control board
- Test of the power boards and components.



TORQUE CHARACTERISTICS

The curves below illustrate typical continuous torque and transient overtorque capabilities for a typical NEMA Design B, 1.0 service factor motor with constant torque and variable torque loads.

Constant Torque



1 Continuous useful torque: Self-ventilated motor [1]
2 Continuous useful torque: Force-cooled motor
3 Transient overtorque
Fn = nominal frequency (50/60 Hz)

[1] Derate by 50% below half speed.

NOTE: Before running the drive above 50/60 Hz, consult motor manufacturer for the overspeed capability of the motor. For constant torque operation, nominal and maximum frequency are adjustable from 25 to 400 Hz for drives ATV66U41N4 to C13N4, or from 25 to 200 Hz for drives ATV66C15N4 to C19N4.

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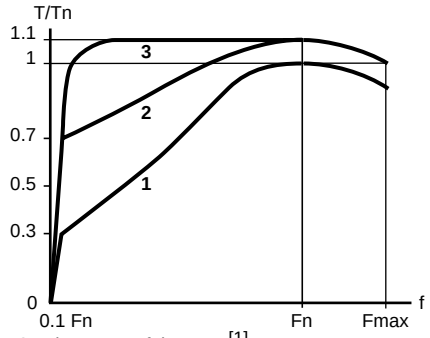
NOTE: Before running the drive above 50/60 Hz, consult motor manufacturer for the overspeed capability of the motor. For variable torque operation, nominal and maximum frequency are adjustable from 25 to 60/72 Hz.

Variable Torque



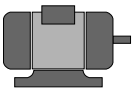
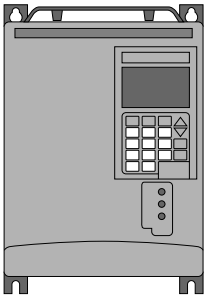
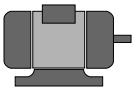
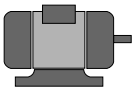
1 Continuous useful torque [1]
2 Transient overtorque
3 Transient overtorque during acceleration
Fn = nominal frequency (50/60 Hz)

[1] Derate by 50% below half speed.

MOTOR-DRIVE COMBINATIONS

The drive can be used in constant torque, variable torque, or variable torque low noise (higher switching frequency) configuration. When set for variable torque without increasing the switching frequency, the drive can be used with a motor one hp size larger than when it is set for constant torque. However, when set for variable torque low noise, the hp rating is the same as for a constant torque drive. See pages 53-56 for ratings.

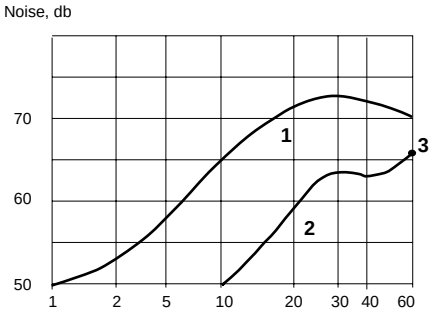
Example:

Motor	Type of Configuration	Drive
P = 7.5 hp (5.5 kW) 	**Constant Torque** Switching frequency = 4 kHz	**ATV66U90N4** **P= 7.5 hp (5.5 kW)** 
P = 10 hp (7.5 kW) 	**Variable Torque** Switching frequency = 4 kHz	
P = 7.5 hp (5.5 kW) 	**Variable Torque Low Noise** Switching frequency = 10 kHz	

SWITCHING FREQUENCY

A high switching frequency allows the drive to supply the motor with a waveform that reduces motor noise. The ALTIVAR 66 is one of a few drives available that randomly modulates the switching frequency to prevent a single tone pitch from developing.

The switching frequency is adaptable in variable torque configuration. Two choices are possible: variable torque or variable torque low noise. With variable torque low noise, the drive has a higher switching frequency.



Audible noise curves generated with a 5 hp, 460 V motor.
1 Variable Torque, switching at 4 kHz
2 Variable Torque, Low Noise, switching at 10 kHz
3 Motor connected directly to input supply.

MOTOR THERMAL OVERLOAD PROTECTION

The motor thermal overload protection for the ALTIVAR 66 drives was specifically designed for self-ventilated motors running at adjustable speeds. The calculation of I^2t as a function of speed takes into account motor current as well as the derating necessary because of lack of motor ventilation at low speed. Motor thermal overload protection takes into account:

- Operating frequency
- Current absorbed by the motor
- Running time
- Assumed maximum ambient temperature ≤ +104 °F (+40 °C) around the motor
- Motor thermal time constant based on assumed motor power

Nominal motor current is factory preset at 0.9 times continuous drive output current. Nominal motor current is adjustable from the keypad display. The drive is factory set for a self-ventilated motor; however, it can be set for a force-ventilated motor from the keypad display.

The motor overload function can replace a conventional class 10 thermal overload relay for single motor applications. However, if the ambient temperature of the motor exceeds +104 °F (+40 °C) or if motors are run in parallel, provide external thermal overload protection. The drive provides UL rated electronic motor thermal protection.

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TORQUE TYPE

Function

This parameter allows you to customize torque type for a specific application.

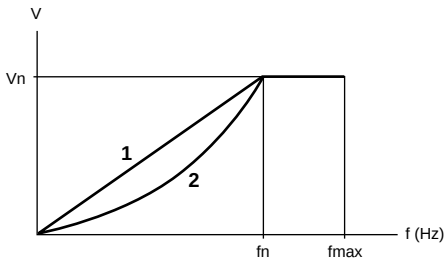
Applications

All constant or variable torque applications with or without overspeed.

Adjustments

Possible settings are:

- Constant torque
- Variable torque
- Variable torque low noise (not available for ATV66C10 to ATV66C31 drives)



1 Constant torque configuration
2 Variable torque configuration
Vn: Nominal motor voltage
fn: Nominal motor frequency
fmax: Maximum output drive frequency

COMMAND TYPE

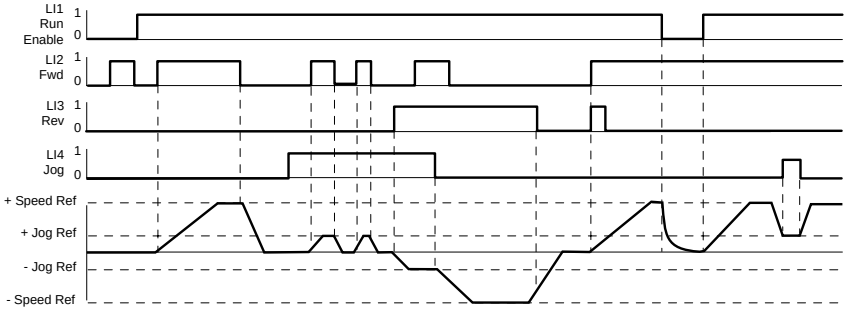
Function

Allows you to select between 2-wire or 3-wire command. The selection affects the operation of LI1 and the forward (LI2) and reverse (LI3, if assigned) inputs. Factory setting is 2-wire command.

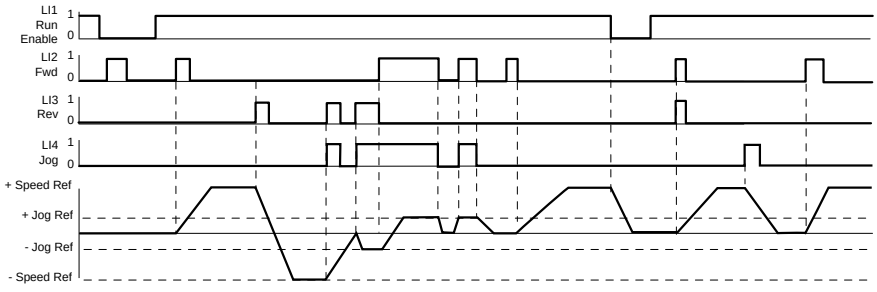
2-wire command allows the AC drive to be restarted without operator intervention after fault reset or restoration of power provided that a run command is present. For applications where automatic restarting may pose a hazard to personnel, the use of 2-wire command is not recommended.

3-wire command requires operator intervention after fault reset or restoration of power to restart the AC drive.

Two Wire Command



Three Wire Command



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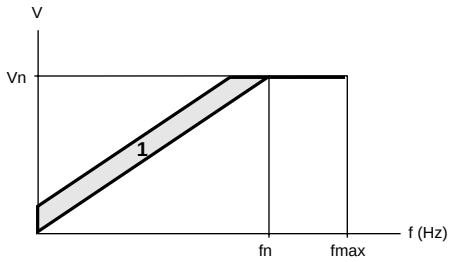
CONTROL TYPE: CONSTANT TORQUE APPLICATIONS

Function

The control type affects the amount of available motor torque and is set dependent on the type of motor used and the application. For constant torque applications, there are 3 choices:

- Normal: A closed loop, current regulated control for most applications which require normal torque at low speed
- High torque: A sensorless flux vector control for machines requiring high torque at low speed and rapid dynamic response.
- Special: Constant volts/hertz control for motors in parallel or special motors such as synchronous permanent magnet motors, synchronous wound field motors, and synchronous reluctance motors.

Normal Control Type



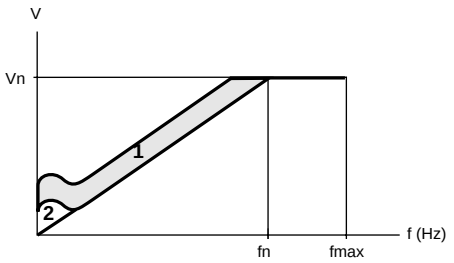
1 Zone within which the drive functions depending on the load and the adjustment of IR Compensation which is used to adjust low speed torque for optimal performance.

Typical maximum overtorque:
ATV66U41N4 to D12N4 & ATV66U41M2 to D12M2: 150% over 50:1 speed range.
ATV66D16N4 to C31N41 & ATV66D16M2 to D46M2: 150% over 50:1 speed range.

The Normal control type is the factory setting for both constant and variable torque configurations. Normal is a sensorless flux vector control. In order to create high torque at low speeds, the AC drive maintains a 90° phase relationship between the rotor and stator electromagnetic fields by continuously calculating the position of the rotor in relation to the electrical position of the stator. It is generally applicable on asynchronous motors and provides good torque performance. Because there are fewer parameters than with the High Torque control type, the process requires less tuning. When using Normal control, the motor horsepower must be equal to or one horsepower size less than the AC drive horsepower.

When Normal control type is used on a constant torque configuration, self-tuning is active. When the AC drive is powered up, a pulse of direct current equal to drive rated current is injected into the motor, allowing the AC drive to determine the resistance of the motor to set the motor parameters.

High Torque Control Type



1 Zone within which the drive functions depending on the load and the adjustments.
2 Adjustment zone for voltage boost.

Typical maximum overtorque:
ATV66U41N4 to D12N4 & ATV66U41M2 to D12M2: 150% over 50:1 speed range.
ATV66D16N4 to C31N41 & ATV66D16M2 to D46M2: 150% over 50:1 speed range.

High Torque control is also sensorless flux vector control, available when the AC drive is configured for constant torque. In order to create high torque at low speeds, the AC drive maintains a 90° phase relationship between the rotor and stator electromagnetic fields by continuously calculating the position of the rotor in relation to the electrical position of the stator. High Torque provides more flexible setup and optimization of parameters than the Normal control type, therefore offering better torque performance.

When High Torque control type is used, self-tuning is active. When the AC drive is powered up, a pulse of direct current equal to motor rated current is injected into the motor, allowing the AC drive to determine the resistance of the motor to set the motor parameters.

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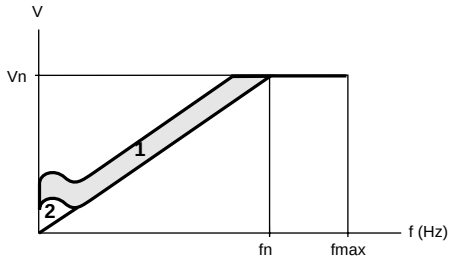
Special Control Type



1 Zone within which the drive functions depending on the load and the adjustments.

2 Adjustment zone for voltage boost.

Typical maximum overtorque:
ATV66U41N4 to C31N41 & ATV66U41M2 to D46M2: 150% over 10:1 speed range.

The Special control type, available when the AC drive is configured for constant torque, maintains a constant volts/frequency ratio throughout the speed range. For example, if the voltage to the motor is 460 V at 60 Hz, it will be 230 V at 30 Hz, functioning as a current limited power supply.

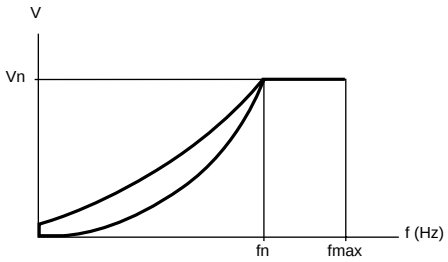
Use Special control when controlling synchronous permanent magnet motors, synchronous wound-field motors, and synchronous reluctance motors.

CONTROL TYPE: VARIABLE TORQUE APPLICATIONS

For variable torque (variable torque or variable torque low noise configuration) applications, 2 choices are available:

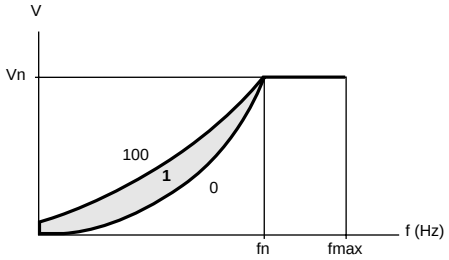
- Normal: A closed loop, current regulated control for all applications. With this choice the profile setting may be adjusted. When Profile is set between 0 and 100, a constant quadratic volts/hertz ratio is implemented.
- NOLD (No Load): A constant volts/hertz control which automatically adapts to the load to minimize power consumption and audible motor noise.

Normal Control Type



Typical maximum overtorque:
ATV66U41N4 to D12N4 & ATV66U41M2 to D12M2: 110% over 50:1 speed range.
ATV66D16N4 to C31N41 & ATV66D16M2 to D46M2: 110% over 50:1 speed range.

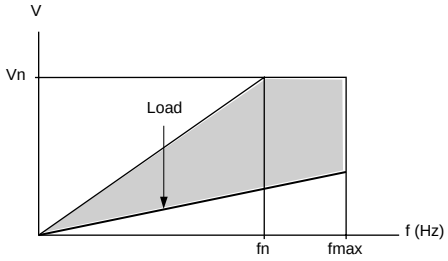
Profile Setting



1 Zone within which the drive functions when Profile is set between 0 and 100.

Typical maximum overtorque:
ATV66U41N4 to C31N41 & ATV66U41M2 to D46M2: 110% over 10:1 speed range.

NOLD Control Type



Shaded area denotes zone within which the drive functions when NOLD is configured.

NOLD control is only available when the AC drive is configured for variable torque. This function maintains a constant volts/frequency ratio during acceleration. Once the motor speed is stable, however, voltage to the motor is automatically reduced as a function of load. At reduced load, the motor voltage is minimized, even at motor base speed. This reduces audible motor noise without reducing motor RPM. NOLD control should not be used with motors in parallel.

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MAXIMUM FREQUENCY

Function

Maximum Frequency clamps the High Speed setting.

Applications

All applications.

Adjustments

Adjustable ranges for Maximum Frequency are:

- Constant torque:
  ATV66U41 to ATV66D79: Nominal Frequency to 400 Hz
  ATV66C10 to ATV66C31: Nominal Frequency to 200 Hz
- Variable torque: Nominal Frequency to 90 Hz

Factory setting is 60 Hz if the input line frequency is 50 Hz, or 72 Hz for an input line frequency of 60 Hz.

LOW SPEED AND HIGH SPEED

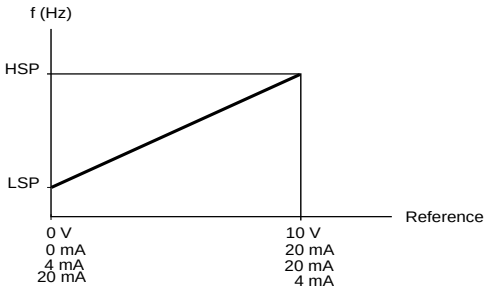
Function

The two frequency limits define the speed range permitted under operating conditions.

Applications

All applications with or without overspeed.

Adjustments



LSP: Low speed
HSP: High speed

Low Speed is adjustable from 0 to High Speed, factory set to 0 Hz. High Speed is adjustable from Low Speed to Maximum Frequency, factory set to 50 Hz if input frequency is 50 Hz, or 60 Hz if input frequency is 60 Hz.

ACCELERATION AND DECELERATION RAMP TIMES

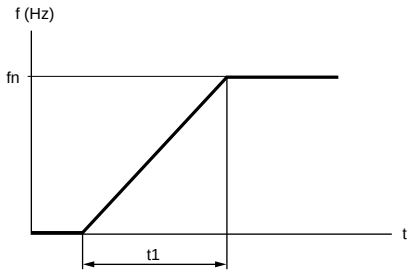
Function

Determines the acceleration and deceleration ramp times, set depending on the application and the torque requirements of the machine. In the case of overcurrent, the ramps will be extended to accelerate or decelerate the connected load as quickly as possible without causing a nuisance trip. Deceleration ramp modification is disabled if the dynamic braking option is installed.

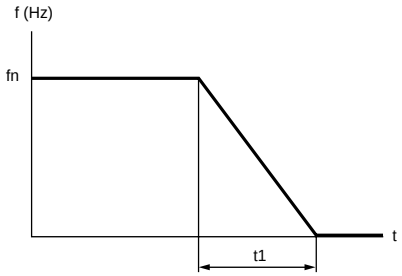
Applications

All applications.

Acceleration



Deceleration



Adjustments

Acceleration and Deceleration times are adjustable between 0.1 and 999.9 seconds, with factory settings of 3 seconds.

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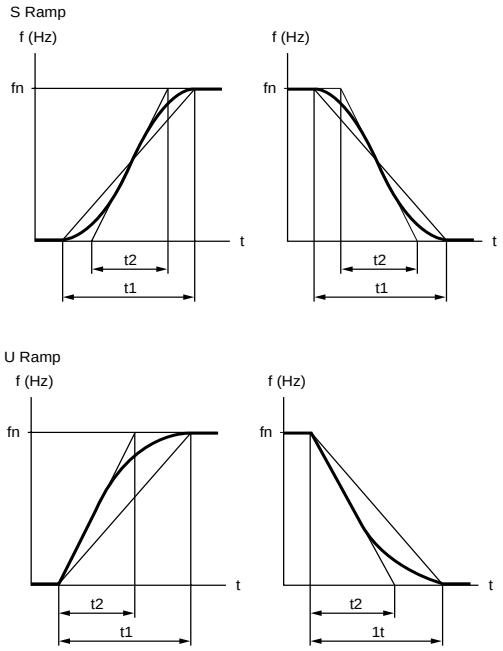
TYPE OF ACCELERATION AND DECELERATION RAMPS

Function

These parameters determine the type of acceleration and deceleration ramps the drive will follow when a Run or Stop command is issued.

Applications

- Material handling and packaging: Use of “S” ramp allows compensation for mechanical play and the suppression of shocks. The “S” ramp also allows the drive to follow the reference during fast transient conditions in the case of high inertia.
- Pumping (installation with centrifugal pump and check valve): The use of the “U” ramp improves control over closing of gravity operated valves.



Adjustments

The acceleration and deceleration ramps can be independently defined as linear (factory setting), “S”, or “U”. A rounding factor adjusts the degree of curvature of the ramp profile. Total ramp time (t1) remains unchanged. If Alternate Ramps is selected, all ramps will be linear.

ALTERNATE RAMPS

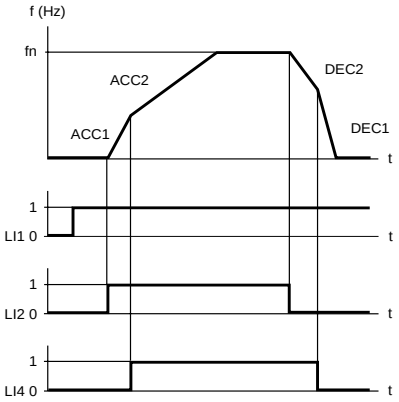
Function

This parameter allows switching between 2 acceleration and deceleration ramp times, separately adjustable. When the Alternate Ramps are used, all ramps are automatically linear. The switch to the alternate ramp is made with a logic input or at a defined frequency threshold.

Applications

- Material handling applications which require smooth starting and stopping.
- High speed spindles with acceleration and deceleration limits above certain speeds.

Example of ramp switching with LI4 input configured for alternate ramp: LI1 = enable, LI2 = start/stop



ACC1: Acceleration ramp 1
ACC2: Acceleration ramp 2
DEC1: Deceleration ramp 1
DEC2: Deceleration ramp 2

Adjustments

Both Acceleration 2 and Deceleration 2 are adjustable between 0.1 and 999.9 seconds. Factory setting for both is 5 seconds.

SKIP FREQUENCIES

Function

This parameter allows suppression of 1, 2, or 3 critical frequency bands to prevent mechanical resonance in the equipment connected to the motor. Each skip point (frequency) selected has a hysteresis of 2 or 5 Hz (selectable) for each skip frequency. The three skip points may overlap each other.

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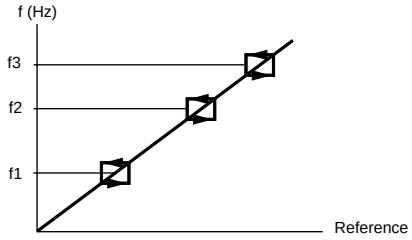
Applications

- Constant torque configuration: Machines with light structure, unbalanced conveyors, handling loose products.
- Variable torque configuration: Fans and centrifugal pumps, in cooling towers and other equipment with light structure.



Adjustments

- 0 Hz to 400 Hz (ATV66U41 to ATV66D79, constant torque)
- 0 Hz to 200 Hz (ATV66C10 to ATV66C31, constant torque)
- 0 Hz to 90 Hz (variable torque)

SLIP COMPENSATION

Function

Maintains a constant motor speed for a given reference as the load changes, automatically correcting the frequency. Normally, the factory setting of automatic compensation is acceptable for most applications.

Applications

Constant torque applications requiring a higher degree of speed regulation.

For variable torque configuration, slip compensation is inhibited.

For constant torque configuration, choose among 3 modes of slip compensation

Adjustments

- No slip compensation: For applications such as high inertia machines and synchronous reluctance motors.
- Automatic: For standard applications. The amount of frequency added to the output is dependent on the reference frequency.
- Manual: For applications such as a motor with very low slip. A constant value entered by the user is scaled according to motor load and is added to the output frequency throughout the speed range. Adjustable from 0.1 to 10 Hz, factory set to 3 Hz.

IR COMPENSATION

Function

IR Compensation is used to adjust low speed torque for optimal performance. IR Compensation attempts to adjust or compensate for the resistive voltage drops of the motor stator windings and the conductors connecting the motor to the AC drive. This ensures good torque performance throughout the speed range of the AC drive.

Applications

IR compensation is only available for constant torque applications.

Adjustments

- 0 to 100% for Normal control type, factory preset at 100%
- 0 to 150% for High Torque control type, factory preset at 100%
- 0 to 800% for Special control type, factory preset at 100%

Normally the factory setting is adequate for most applications.

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VOLTAGE BOOST

Function

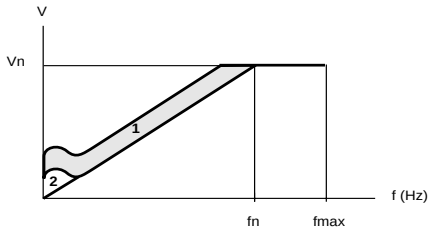
Voltage Boost allows for optimal voltage and torque boost during starting.

Applications

Voltage Boost is available when the AC drive is configured for constant torque, with High Torque and Special control types.

Adjustments

Voltage Boost can be set between 0 and 100% of nominal voltage. Factory setting is 20%. Normally, the factory setting of Voltage Boost is adequate for most applications. For loads which require moderate to high break-away torque to achieve initial rotation, adjustment of Voltage Boost may be required.



1 Zone within which the AC drive functions depending on the load and adjustments (IR Compensation)

2 Adjustment zone for voltage boost

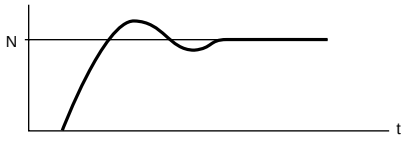
DAMPING

Function

Damping adapts the drive to different machine torque demands by adjusting the integral gain of the frequency loop to match the inertial response of the load to the frequency response of the drive. This gives optimal performance during transient conditions. In constant torque configuration with high torque control, a second frequency loop gain adjustment is accessible to optimize dynamic performance (see Bandwidth on page 21). It increases speed response, causing the drive to react faster to a change in speed or a load impact.

Applications

All constant or variable torque applications with or without overspeed.



An increase in gain is used for machines with fast cycles and low inertia.

A reduction in gain is used for machines with high resistant torque or high inertia.

Example: A reduction of gain is used for overspeed when in transient conditions.

Adjustments

- 1 to 100% for Normal and High Torque control with constant torque configuration.
- 1 to 100% for NOLD control with variable torque configuration
- 1 to 800% for Special control with constant torque configuration
- 1 to 800% for Normal control with variable torque configuration

Normally the factory setting is adequate for most applications.

PROFILE

Function

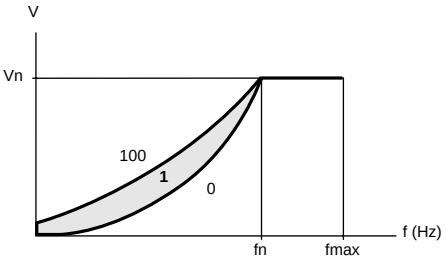
This parameter shapes the V/Hz profile of the output.

Applications

Profile is used when the AC drive is configured for variable torque, with Normal control type.

Adjustments

Profile can be set to a value between 0 and 100, factory preset to 20. During changes in speed command, the V/Hz profile becomes linear, intersecting the Vn and fn points (see figure below). As a result, there is no reduction in available motor torque during speed changes.



Shaded area denotes zone within which drive functions when Profile is set between 0 and 100.

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BANDWIDTH

Function

Bandwidth is a second frequency loop gain available with Damping. Bandwidth increases speed response, causing the AC drive to react faster to a change in speed or a load impact.

Applications

Bandwidth is available for constant torque applications with High Torque control type.

Adjustments

Bandwidth can be set to a value between 0 and 100%. Factory setting is 20%. For most applications, no adjustment of Bandwidth should be required. For applications where motor speed or load changes occur rapidly, the Bandwidth setting can be adjusted to optimize the AC drive response to these changes. Increasing the Bandwidth setting allows the AC drive to respond to rapid variations in speed or load. Decreasing the Bandwidth setting lessens the AC drive's ability to respond. If set too high for a given application, the AC drive output frequency can exhibit instability or excessive sensitivity to load disturbances at the commanded speed.

NOMINAL CURRENT

Function

Nominal Current is the motor nameplate value for full load current.

Applications

All applications.

Adjustments

Adjustable from 45% to 105% of the AC drive's current rating, factory preset to 90%. Set Nominal Current to equal the motor full load current. The Nominal Current parameter does not affect the maximum current that the AC drive can produce, i.e. Current Limit. However, changing the Nominal Current parameter can change the value of motor overload current. Check and adjust, if necessary, the value of motor overload if nominal current is changed.

NOMINAL FREQUENCY

Function

Nominal Frequency corresponds to the point on the V/Hz curve beyond which voltage remains virtually constant and only frequency increases. Nominal Frequency often corresponds to the base frequency of the motor, which is usually the same as the line frequency of the connected power system. With special motors or applications, Nominal Frequency may be different than the connected power system line frequency.

Applications

All applications.

Adjustments

Upon first power-up, the AC drive senses the connected power system frequency. If this value is 50 Hz, Nominal Frequency is set to 50 Hz. If it is 60 Hz, Nominal Frequency is set to 60 Hz. For special motors and/or applications, select Special and enter a value between 25 and 400 Hz (ATV66U41 to ATV66C13, constant torque); 25 and 200 Hz (ATV66C15 to ATV66C31, constant torque); or 25 and 90 Hz (variable torque).

NOMINAL VOLTAGE

Function

Nominal Voltage corresponds to the point on the V/Hz curve beyond which voltage remains virtually constant and only frequency increases. Nominal Voltage is used with Nominal Frequency to determine the V/Hz baseline. Nominal Voltage often corresponds to the base voltage of the motor, which is usually the same as the line voltage of the connected power system. With special motors or applications, Nominal Voltage may be different than the connected power system line voltage.

Applications

All applications.

Adjustments

On 400/460 V units, select the value of the motor supply voltage from the following: 380-400-415-440-460. Upon first power-up, if the input line is 50 Hz, the AC drive is configured for 400 V Nominal Voltage. If the input line is 60 Hz, the AC drive is configured for 460 V Nominal Voltage.

On 208/230 V units, select the value of the motor supply voltage from the following: 208-220-230-240. Upon first power-up, the AC drive is configured for 230 V for 50 Hz and 60 Hz input lines.

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ROTATION NORMALIZATION

Function

This parameter allows motor rotation direction to be inverted (from ABC to ACB) so that the motor shaft rotation agrees with the forward and reverse logic inputs. No power wiring has to be changed to correct rotation.

Applications

All applications.

TORQUE LIMIT MOTOR AND TORQUE LIMIT GENERATOR

Function

These two parameters allow the limitation of torque, independent of current limit, with separate adjustment for the motor and generator (AC drive with dynamic braking) quadrants. When using generator torque limit, the overspeed function is active. If the action of the generator torque limit causes the actual motor frequency to be greater than the desired motor frequency by ≈10 Hz, then an overspeed trip will occur.

- By analog input: a 0-20 mA, 4-20 mA, or 20-4 mA input can be used as a drive torque reference for simple motor torque control.
- By logic input: when the assigned logic input is low, the torque limit value is the default setting. When the logic input is high, the torque limit value is the user-programmed value.

Applications

Applications where it is desirable to limit torque output of the motor. Torque limit is only available in constant torque control types.

Adjustments

Both parameters can be set to a value between 0 and 200% of nominal motor torque, factory preset at 200%.

CURRENT LIMIT

Function

This parameter limits maximum drive current to an adjustable level. Reduction is possible by three methods:

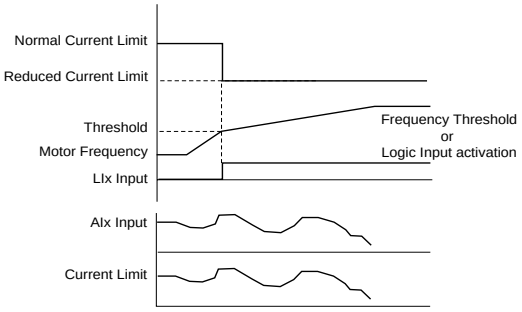
- By frequency level: Current Limit is at reduced level when drive exceeds a programmed frequency.
- By analog input: a 0-20 mA, 4-20 mA, or 20-4 mA input can be used as a drive current reference for simple motor torque control.
- By logic input: when the assigned logic input is low, the current limit value is the default setting. When the logic input is high, the current limit value is the user-programmed value.

Applications

Constant torque:

- Machines which may frequently jam such as conveyors, grinders, extruders
- Torque regulation or simple tension-controlled applications
- Cut to length with stopping and holding against a mechanical stop
- Constant torque or variable torque: When a motor is used that has a power less than that of the drive (in this case, set the activation method to frequency level and set the frequency threshold at zero).

Example:



Adjustments

Current Limit can be set to a value between 40 and 150% of AC drive output current for constant torque applications, or from 40 to 110% of AC drive output current for variable torque configurations. Default values are:

- Constant torque: 150% of output current for input frequency of 60 Hz, 136% for input frequency of 50 Hz
- Variable torque: 110% of output current

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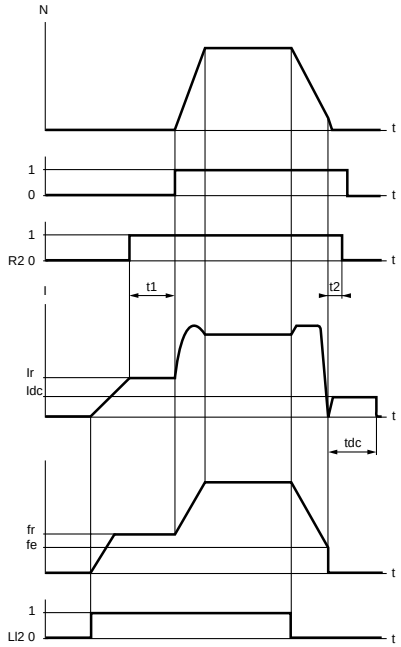
BRAKE SEQUENCE

Function

Brake control sequencing is generated by the drive in constant torque configuration to activate and coordinate mechanical brake actuation. It allows the sequencing of AC drive output, mechanical brake actuation, and DC injection for smooth starting and stopping.

Applications

- Material handling machines equipped with fail-safe brakes, such as hoisting machines.
- Machines which need a holding brake, such as an unbalanced machine.

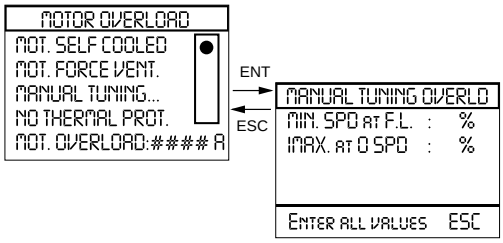


t1: Adjustable brake release time
t2: Adjustable delay following the stop
tdc: DC injection time
Ir: Brake release current threshold
Idc: DC injection current level
fr: Frequency for releasing the brake
fe: Frequency for engaging the brake

MOTOR THERMAL OVERLOAD PROTECTION

Function

The ALTIVAR 66 drives provide indirect motor thermal protection by continuously calculating the theoretical thermal state of the motor. The drive will trip if this state reaches 109% of nominal current.

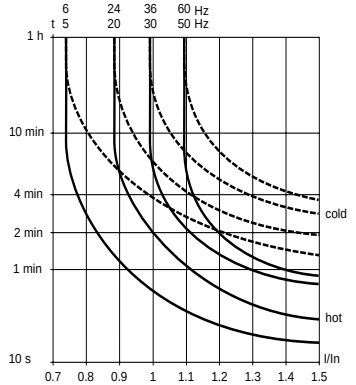


Motor Overload enables the AC drive to protect a standard asynchronous induction motor from overload. This function can replace a conventional class 10 thermal overload relay for single motor applications; however, multi-motor applications require individual external thermal overload motor protection.

This function is effective in protecting a motor operated from the ALTIVAR 66 drive because it considers motor speed as well as time and current in its protection algorithm. This is important since most motors applied on AC drives are self-cooled, and their cooling effectiveness declines at lower speeds. This protection algorithm integrates motor current over time, taking into account factors such as stop time and idle time.

Applications

All applications with self-ventilated motor.



Constant torque configuration: See thermal protection trip curves at left.

Variable torque configuration: Use the same curves but overload is limited to I/In = 1.1.

The microprocessor calculates the theoretical thermal state of the motor from:

- Operating frequency
- Current absorbed by the motor
- Running time
- Assumed maximum ambient temperature of 40° C around the motor.
- Motor thermal time constant based on assumed motor power

Types of Protection

Self-Cooled Motor

With this type of motor overload protection, the motor base frequency is assumed to be the same as the nominal rated frequency. Enter the motor full load amps for Motor Overload current value.

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The overload time–current characteristic is set to allow operation at motor rated current above 50% of motor base speed. Below 50% of motor base speed, the time-current characteristic is linearly tapered so that at zero speed, the drive will trip on overload at continuous operation above 25% of the motor overload setting.

The I^2t curve, which is used to determine when to trip on a motor overheat condition, emulates a class 10 thermal overload curve if nominal rated frequency is 60 Hz. If nominal rated frequency is 50 Hz, it emulates the European standard curve.

Force-Ventilated Motor

This type of motor overload protection is the same as that for a Self-Cooled Motor except that the overload time-current characteristic is set to allow operation at motor rated current throughout the speed range. The drive will trip on overload if the motor current exceeds the set level.

Manual Tuning

Manual Tuning works in the same way as the Self-Cooled Motor except that minimum speed at full load (MIN. SPD at F.L.) and maximum current at zero speed (IMAX at 0 SPD) are both programmable, as is the Motor Overload Current value.

No Thermal Protection

External thermal overload relays are required when more than one motor is connected to the output or when the motor connected to the AC drive is less than half the AC drive rating, or with a permanent magnet or wound field synchronous motor. When external overload protection is provided, select “No Thermal Protection”.

NOTE: When “No Thermal Protection” is selected for the ATV66C23 to ATV66C31 AC drives, the thermal protection is set to a level which limits the maximum continuous current to prevent AC drive damage.

Adjustments

Motor Overload Current is adjustable from 0.45 to 1.15 times nominal drive current, factory preset to 0.9 times nominal drive current.

DISPLAY CONFIGURATION

The keypad display can be configured to show:

- One parameter displayed in bar graph form (factory setting)
- Two parameters displayed in bar graph form
- Four parameters displayed in tables

When the drive is running, the possible display parameters are:

- Drive parameters: Frequency reference, output frequency, output current, output power, output voltage, input voltage, DC bus voltage, drive thermal state, and elapsed run time
- Motor parameters: Motor torque, motor thermal state, and motor speed
- User-defined parameters: Machine reference and machine speed, set according to the application by entering a scale factor and a definition of units

When the drive is running and the keypad display is configured for one bar graph, you can successively display the other parameters by scrolling with the ▲ and ▼ keys. If the keypad display is configured for two bar graphs and you scroll with the ▲ and ▼ keys, the first bar graph remains fixed, while other parameters are displayed successively on the second bar graph. If the keypad display is configured for four parameters, you can successively display the other parameters by scrolling with the ▲ and ▼ keys.

KEYPAD CONFIGURATION

The keypad configuration menu allows:

Selection of Command Mode

- Terminal command: Command of the drive from the terminal strip inputs
- Keypad command: Local command of the drive by the keypad Run and Stop keys. In this command mode, it is not necessary to wire the analog and logic input terminals, except for LI1 to +24VDC.
- Switching between Terminal and Keypad command:
  - By a logic input (LI3 or LI4) reassigned to this function or
  - By using the F2 function key (not reassignable in this case)

Programming the Function Keys

The three function keys can be assigned to several different functions along with Terminal/ Keypad Switching. Possible assignments are:

- Direction: Forward or reverse direction
- Jog
- Fault Reset: Allows the drive to be reset after certain faults if the cause of the fault has disappeared.

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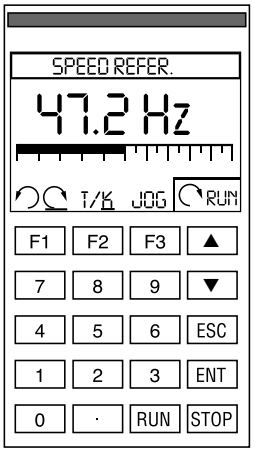
- Scroll: Allows the successive display of values when the drive is running.
- Preset Speeds 1 and 2: Running at Preset Speed 1 or 2.

Use of Keypad Command

- When the drive is running, the codes for the assignments of F1-F2-F3 are displayed on the bottom line of the screen.
- The commands are activated by momentarily pressing the function key, except in the case of Jog and Scroll which are only active as long as the function key is held.
- The Run and Stop keys are used to start and stop the motor.
- ▲ increases reference frequency, ▼ decreases reference frequency; or reference frequency can be entered by pressing decimal point key, entering frequency and pressing the ENT key.
- Direction can be changed with an assigned function key. If no function key is assigned to direction, the direction is forward.



- A plastic cover is factory installed over the Run and Stop keys. It can be removed to access the Run and Stop keys and reinstalled.

APPLICATION FUNCTIONS

The ALTIVAR 66 drive incorporates application functions so that a portion of the external control typically found in drive systems can be eliminated. Application functions use the drive logic inputs and outputs.

The drive contains four logic inputs LI1, LI2, LI3 and LI4, two of which can be reassigned (LI3 and LI4). LI3 is factory set for reverse direction and therefore can be reassigned for applications which only require running in one direction. LI4 is factory set for Jog.

Choice of application functions is limited by:

- The number of reassignable logic inputs on the drive. If necessary, an I/O Extension Module can be used to increase the number of inputs (catalog number VW3A66201T or VW3A66202T, see page 35).
- The incompatibility between certain functions.

Read up and across from the ● to identify pairs of incompatible functions. Incompatibilities due to the number of I/O available for reassignment are not shown.	RUN REVERSE	JOG	+/– SPEED	SETPOINT MEMORY	PRESET SPEEDS	SPEED REFERENCE	AUTO / MANUAL	CONTROLLED STOP	SHUTDOWN	BYPASS	BRAKE SEQUENCE	MOT. SELECT SWITCH	PI REGULATOR
RUN REVERSE													●
JOG									●				●
+ / – SPEED				●	●								●
SETPOINT MEMORY			●		●		●					●	●
PRESET SPEEDS			●	●									●
SPEED REFERNCE													●
AUTO / MANUAL				●									●
CONTROLLED STOP									[1]		●	●	
SHUTDOWN		●						[1]			●	●	●
BYPASS													
BRAKE SEQUENCE								●	●				●
MOT. SELECT SWITCH				●				●	●				●
PI REGULATOR	●	●	●	●	●	●	●		●		●	●	

[1] Shutdown is incompatible with Controlled Stop by Frequency Threshold and Controlled Stop by Frequency Threshold/Logic Input.

RUN REVERSE

Function

Requires one logic input. The drive runs in reverse when the assigned logic input is high. The input is a maintained signal if 2-wire control is selected, or edge-triggered with 3-wire control. Logic input LI3 is factory preset for this function. If the application has only one direction of rotation, input LI3 can be reassigned to another function.

Applications

All applications with two directions of rotation.

JOG

Function

Jog requires one logic input. The drive runs at the programmed jog speed as long as the assigned logic input is high. Time between jog pulses is determined by the programmed duty time. Logic input LI4 is factory preset for this function. An output can be assigned to indicate that the drive is jogging.

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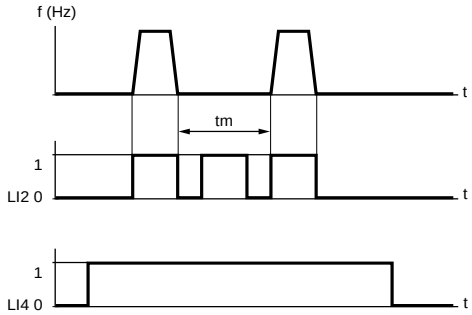
Applications

All machines which require a slight move during start up, positioning, threading, or maintenance.



LI2: Forward direction
LI4: Jog

Adjustments

Jog speed is adjustable from 0.2 to 10 Hz, factory preset to 5 Hz. Duty Cycle is adjustable from 0.2 to 10 seconds, factory preset to 0.5 seconds.

+SPEED/-SPEED

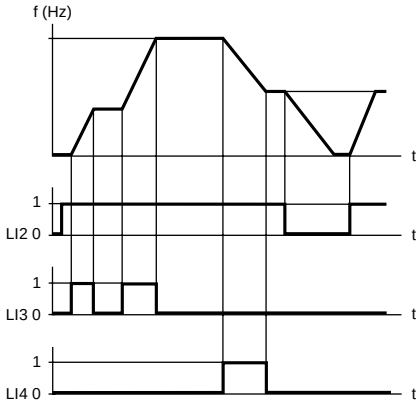
Function

This function requires two logic inputs. When the logic input assigned to +Speed is high, output frequency is increased. When the input assigned to -Speed is high, output frequency is decreased. The function can be used with or without storing the last reference. In this mode, if the drive is stopped and then started again, it accelerates to its last speed. This function is similar to a motorized potentiometer.

Applications

- Speed command of a drive from several pushbutton operating stations.
- Logic command of several drives requiring coordinated speed changes.

Example with storing of last reference:



LI2: Forward Direction
LI3: + Speed
LI4: - Speed

SETPOINT MEMORY

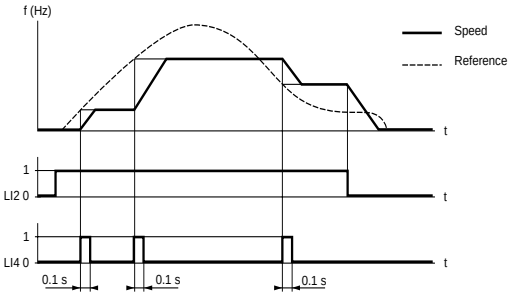
Function

Setpoint memory allows the speed of several drives to be controlled by one analog reference and a logic input for each drive.

This function requires one logic input. If the assigned logic input goes high for longer than 0.1 seconds, the drive will store the analog reference at that time and run at that frequency. This frequency is maintained until the next logic input pulse, the removal of the direction input (2-wire command), or removal of the run enable input.

Applications

- Slow process sectional line with several drives.
- Conveyor systems.



LI2: Forward Direction
LI4: Setpoint Memory

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PRESET SPEEDS

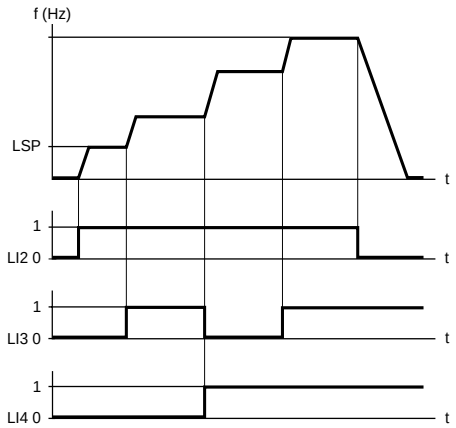
Function

This parameter allows switching between 1 or 3 Preset Speeds, with an additional speed obtained when the assigned logic inputs are both low. 1 Preset Speed requires one logic input. 3 Preset Speeds requires two logic inputs. Use of an I/O Extension Module allows 7 Preset Speeds (see page 36).

Applications

Material handling and machines with several operating speeds.

Example with four speeds:



LI2: Forward Direction
LI3: Logic Input a
LI4: Logic Input b

	Logic Input a	Logic Input b
Low Speed or Reference	0	0
Preset Speed 1	1	0
Preset Speed 2	0	1
Preset Speed 3	1	1

Adjustments

Preset Speeds are adjustable from 0.1 to 400 Hz (ATV66U41 to ATV66D79, constant torque); 0.1 to 200 Hz (ATV66C10 to ATV66C13, constant torque); or 0.1 to 90 Hz (variable torque). Factory preset value for 1 Preset Speed is 5 Hz, for 3 Preset Speeds 5, 10, and 15 Hz.

SPEED REFERENCE

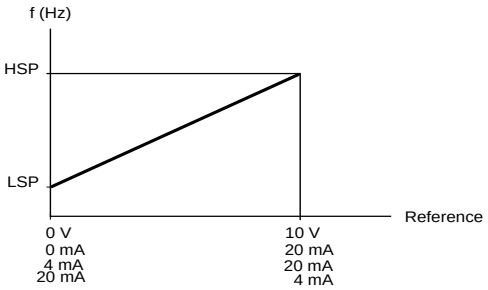
Function

This parameter allows assignment of the AI1 and AI2 inputs as Speed Reference 1 or Speed Reference 2. The characteristics of the analog current input AI2 can be modified. Factory setting is 4-20 mA. Other programmable values are: 0-20 mA, 20-4 mA, or x-20 mA where x is programmable from 0 to 20 mA. A switch on the control board also allows AI2 to be used as a 0-5 V voltage input. The voltage input AI1 (0-10 V) cannot be modified.

The AI1 and AI2 inputs are summed as a factory default, limited to High Speed. However, when Auto/Manual is active, the inputs function independently, and only one is active at a time. It is possible to multiply AI2 by (-1) in which case AI2 is subtracted from AI1. If Clamp Sum is set to Yes and (AI1-AI2) is zero or negative, the drive will run at Low Speed. If Clamp Sum is set to No and (AI1-AI2) is negative, the drive will change direction.

Applications

- Most all applications require a speed reference.



LSP: Low speed
HSP: High speed

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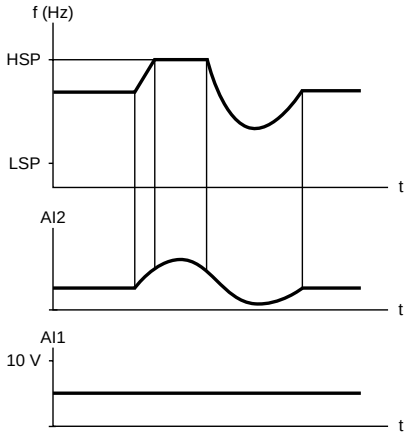
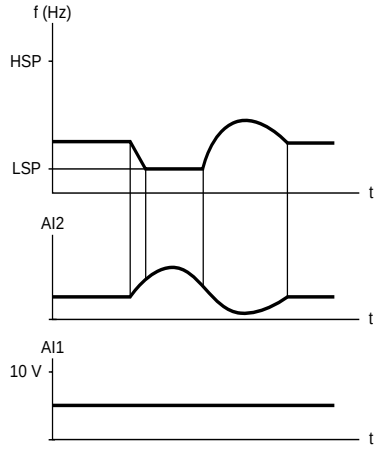
Applications using the sum feature

- Applications with a current reference input other than 4-20 mA.
- Machines where the speed is corrected by a signal at the AI2 input.

Adding References



Subtracting References



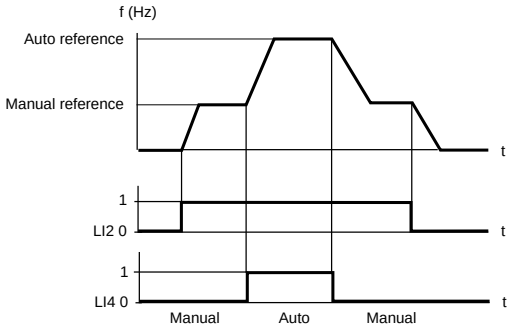
AUTO/MANUAL

Function

Auto/Manual requires 1 or 2 logic inputs. It allows switching between two analog references using a logic input. This function eliminates the need for mechanical switching of the low level analog inputs and allows the speed references to be independent.

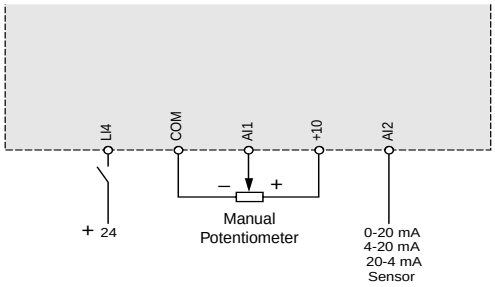
Applications

All machines with automatic/manual operation. Automatic speed command comes from a sensor on input AI2 when the logic input is at state 1 (high). Manual speed command comes from a potentiometer on input AI1 (local control) when the logic input is at state 0 (low). A second logic input can be used for an additional 2-wire remote run command, only active when the drive is in Auto mode.



LI2: Forward Direction
LI4: Automatic/manual

Wiring Schematic example



CONTROLLED STOP

Function

Controlled stop requires zero or one logic inputs. It allows frequency threshold and logic inputs to work together to modify normal stopping. Three types of stop modification are available:

- Freewheel: Motor coasts to a stop. Stopping time depends on inertia and resistive torque.
- Fast stop: Braking to standstill with the minimum deceleration ramp time acceptable for the drive-motor combination without tripping.
- DC injection braking: Adjustment of time and current level.

Three ways to activate controlled stop:

- Assign one logic input and define its active state as 0 or 1. When the logic input goes to its

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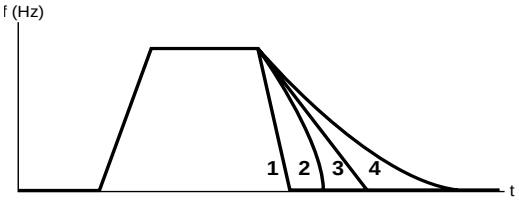
active state, the drive stops, following the controlled stop method.

- Set a frequency threshold. When a stop command is received, the drive decelerates following its programmed decel time. When the frequency threshold is reached, the drive switches to the controlled stop method.
- Assign a logic input, set a frequency threshold, and choose a stopping method for both command types.

When in Terminal Command mode, controlled stop is active both at the frequency threshold and with the logic input. When in Keypad Command mode, controlled stop by frequency threshold is active, but controlled stop by logic input is disabled.

Applications

- Freewheel stop: if coast to stop is preferred.
- Fast stop: applications requiring rapid stopping.
- DC injection braking: Braking at low speed for fans and material handling applications.



1 Fast stop
2 DC injection braking
3 Normal stop following deceleration ramp
4 Freewheel stop

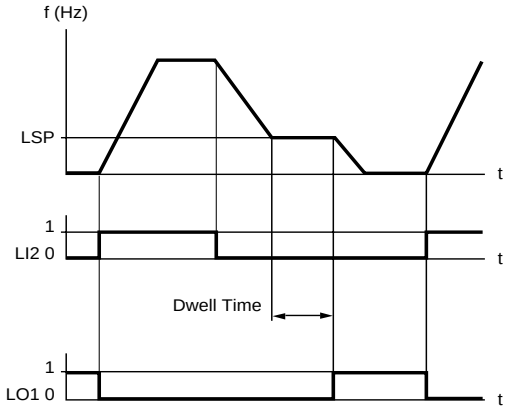
SHUTDOWN

Function

Maintains low speed for an adjustable amount of time after deceleration. When the dwell state has expired, the drive can activate a logic output to indicate the end of running at dwell speed. No logic inputs are required for shutdown. One logic output can be used.

Applications

- Pumping station: Controlling the closing of a check valve before completely stopping.
- Positioning which requires a great deal of precision.



LI2: Forward Direction
LO1: Shutdown Complete

Adjustments

Dwell time is adjustable from 0.1 to 60 seconds, factory preset to 1 second.

MOTOR SELECT SWITCH

Function

Motor Select Switch provides the capability to program the AC drive with multiple sets of drive and/or control parameters for use with 1, 2, or 3 motors. Motor Select Switch is useful for applications in which a single AC drive is used to control multiple motors individually, or for applications in which multiple control parameter sets are required for a single motor.

If multiple motors with different power, enclosure types, or speed ratings are used with a single controller, separate motor contactors, thermal protection, and short circuit protection will be required for each motor. When 2 motors or 3 motors are selected, logic input port(s) must be selected for receiving motor switching logic inputs.

Applications

- Material handling with several movements, two of which are not simultaneous.
- Machines with several sections, two of which do not operate simultaneously.
- Machines with one motor and two different fabrication processes.

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PI REGULATOR

Function

PI Regulator makes it possible to control a process by adjusting motor speed using a setpoint input and a feedback input. PI Regulator requires, at minimum, two analog input ports. Additional analog and logic input ports are required for other optional PI Regulator functions. PI Regulator can only be used when the AC drive is configured for 2-wire control.

The following analog output signals are available

- Analog output reference proportional to PI set point
- Analog output reference proportional to feedback
- Analog output reference proportional to PI error
- Analog output reference to proportional to PI integral error

The following logic outputs signals are available.

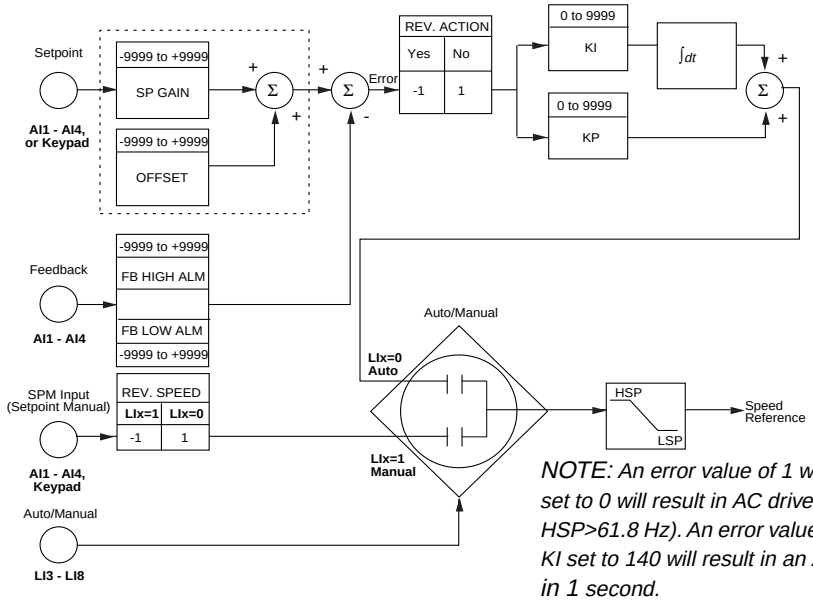
- Logic output indicating that “PI FLT ratio” has been exceeded. “PI FLT ratio” is a user defined error limit between desired setpoint and actual process feedback.
- Logic output indicating that high level alarm has been exceeded, which indicates the process is above programmed level.
- Logic output indicating that the feedback is less than low level alarm, which indicates the process is below programmed level.

The set point may be entered at the keypad or via an analog input, AI1, AI2, AI3, or AI4. The feedback signal may be entered via any analog input, AI1, AI2, AI3, or AI4. (AI3 and AI4 are available only if extended I/O option board is installed.) Refer to the block diagram for inputs.

Applications

- Control flow rate or pressure in a pumping system.
- Maintain liquid level in a reservoir.

See the PI Regulator block diagram below.



NOTE: An error value of 1 with KP set to 100% and KI set to 0 will result in AC drive output of 61.8 Hz (if HSP>61.8 Hz). An error value of 1 with KP set to 1% and KI set to 140 will result in an AC drive output of 61.8 Hz in 1 second.

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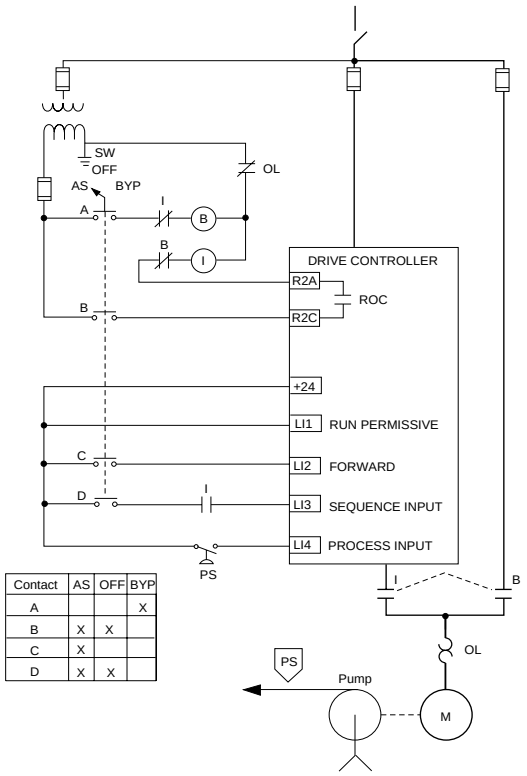
BYPASS FUNCTION

Function

The Bypass function is used to sequence a drive output isolation contactor, commonly used along with a bypass contactor. The bypass contactor and its associated power circuit components permit starting, running, and stopping of the motor directly from line power. The Bypass function requires one or two logic inputs, and one relay output.

Applications

Bypass requires a specific wiring scheme (see figure below). Applications include machines which must be run continuously because of the manufacturing process, or when running the motor at full speed is required when the drive must be taken off line for service or repair.



Contact	AS	OFF	BYP
A			X
B	X	X	
C	X		
D	X	X	

Operation

A programmed delay time (ROC) allows for the decay of residual motor voltage before restarting the drive after operating in bypass. If the drive is commanded to run and the delay time has expired, the relay assigned to Run output command goes high, energizing the isolation contactor and enabling the motor to run.

A logic input is assigned as a Sequence input. If this input does not go high within a programmable amount of time, the drive faults on a Sequence Time-out Fault and will not start.

A second logic input can be assigned as a Process input. This verifies the occurrence of a user-defined event after the acceleration ramp has begun. If this input does not go high within a programmable amount of time, the drive faults on a Process Time-out Fault and stops.

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FAULT MANAGEMENT

Fault Stop

To protect internal circuitry, certain faults always cause a freewheel stop. For other faults, the type of stop can be programmed:

- Normal stop: Drive follows the active deceleration ramp
- Fast stop: Drive stops as quickly as possible without causing a trip
- Freewheel stop: Drive output is turned off, causing the motor to coast to a stop

Only one choice is possible and it is applied to all the programmable faults

Type of Reset

There are three methods for resetting the drive after a fault:

- Automatic restart (available only when drive is configured for 2-wire command). 1-5 restart attempts and 1-600 second delays between attempts can be selected.
- Manual restart: removal of power, correcting the cause of the fault, then reapplication of power
- Fault reset by logic input or function key

Fault Stop and Restart Methods

	Resettable Only By Manual Reset (Removal Of Power)	Fault Reset by LI, Function Key, or Manual Reset	Can be Automatically Reset	Non-Latching Faults
Faults Causing Freewheel Stop	Short circuit Ground fault Precharge failure Internal fault Memory failure Dynamic brake fault Dynamic brake resistor fault Auto-test failure Transistor short circuit Open transistor Link Fault	AC line overvoltage DC bus overvoltage Sequence time-out fault Overspeed Output phase loss	AC line overvoltage DC bus overvoltage Sequence time-out fault Overspeed Output phase loss	Undervoltage
Programmable Fault Stop		Drive overtemperature Motor overload Loss of follower Process time-out fault Serial link fault	Drive overtemperature Motor overload Loss of follower Process time-out fault Serial link fault	Input phase failure

FAULT CONFIGURATION

Along with the type of stop and restart, there are several other possibilities for fault configuration:

- At the loss of input power, the drive can either freewheel stop or follow a ramp.
- Input phase failure. This can be inhibited if a line contactor is used with the drive and control power is supplied separately to CL1-CL2.
- Output phase failure. This can be inhibited for troubleshooting or when the motor connected to the drive is less than 45% of drive power.
- When the 4-20 mA or 20-4 mA reference input is less than 3 mA, the drive can be programmed to fault, run at a preset speed, or ignore the loss of follower.
- Fault reset function allows the restart of the drive after certain faults using an assigned logic input.
- If the drive has dynamic braking, the drive can check for a short circuit and issue a fault if the rating of the dynamic brake resistor is exceeded based on programmed resistor characteristics.
- Motor thermal overload protection can be configured and adjusted. See page 23.
- Catch on fly to regain control of a spinning load after loss of power.

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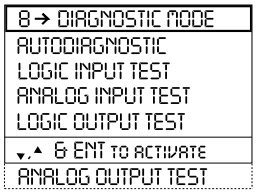
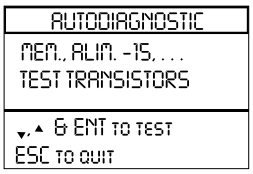
DIAGNOSTIC MODE



The diagnostic mode allows access to various tests:

- Drive autodiagnostics for locating failed components in case of one of the following faults: short circuit between phases, short circuit to ground, internal fault, transistor in short circuit, or transistor open.
- Testing of the inputs and outputs with forcing of the outputs.

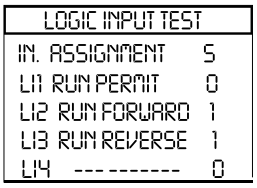


Autodiagnostics

Two tests are available in this menu. Selecting the first line of the Autodiagnostic menu initiates a test on the ROM memory, confirms the presence of ± 15 V, and confirms presence of supply frequency.

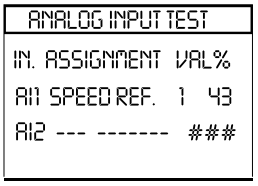
Selecting the second line initiates a test sequence on the drive transistor bridge.

At the end of the test, each tested element is displayed with its test result: “OK” indicates the tested element is good; “X” indicates it is defective.



Logic Input Test

This menu allows you to change the state of the logic inputs to check for good wiring connections. When the Logic Input Test screen is active, changes made to the inputs will change input bit status without affecting the state of the AC drive.



Analog Input Test

Analog Input Test is similar to Logic Input Test. When this screen is active, you can change the state of the analog inputs to check for good wiring connections without affecting the state of the AC drive.

Logic Output Test

This menu allows you to change the state of the logic outputs to check for good wiring connections without affecting AC drive operation.

When the Logic Output Test screen is active, all outputs are forced to low (0) state regardless of actual AC drive settings. Changes then made to the outputs will alter bit status without affecting the state of the AC drive. When you leave the Diagnostic Mode and return to Main menu, the logic outputs resume the programmed settings in place before the test sequence.

Analog Output Test

This menu allows you to change the value of the analog outputs to check for good wiring connections without affecting AC drive operation.

When the Analog Output Test screen is active, all output values are forced to 0 regardless of actual AC drive settings. Changes then made to the outputs will alter the setting without affecting the state of the AC drive. When you leave the Diagnostic Mode and return to Main menu, the analog outputs resume the programmed settings in place before the test sequence.

The use of diagnostic mode requires:

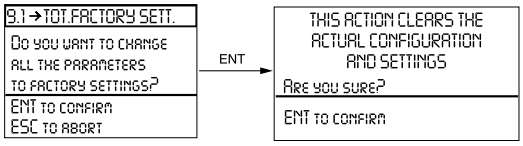
- Removal of power from L1, L2, L3
- Bus capacitors discharged
- Presence of control power at CL1 and CL2
- Motor connected and stopped

RECALLING AND STORING ADJUSTMENTS

The ATV66 drive allows you to partially or totally reset the drive to factory settings. If partial recall is selected, only the parameters available from the Display Configuration, Keypad Configuration, and General Configuration menus are reset to their factory conditions. If total recall is selected, all parameters are reset to their factory settings.

Customer parameter settings can be stored on a PCMCIA card installed in the drive (catalog number VW3A66901T). This allows the drive configurations and adjustments to be saved and then downloaded in another drive of equal horsepower.

Although only the size of a credit card, the PCMCIA memory card with EEPROM allows very fast access and transfer times. 16 different sets of parameters can be stored on the PCMCIA card.



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INPUT AND OUTPUT ASSIGNMENTS

The ALTIVAR 66 basic drive has 2 analog inputs, 4 logic inputs, 2 analog outputs, and 4 logic outputs. Some of these are fixed and cannot be reassigned. If more inputs or outputs are required, the I/O Extension Module can be used (see page 35).

Analog Inputs

The analog inputs AI1 and AI2 are assigned to Speed Reference. They can be assigned to:

- Current limit input
- Torque limit input
- PI functions

Logic Inputs

The only logic inputs which can be reassigned are LI3 and LI4. LI1 is fixed as Run Enable, and LI2 is fixed as Run Forward. Logic inputs LI3 and LI4 can be assigned to:

- Run Reverse
- Auto/Manual
- Preset Speeds
- Jog
- Controlled Stop
- Terminal/Keypad Switching
- +Speed/-Speed (requires 2)
- Bypass
- 3 Preset Speeds (requires 2)
- Setpoint Memory
- Motor Select Switch
- PI Regulator

Analog Outputs

There are 2 analog outputs which can be programmed as 0-20 mA or 4-20 mA outputs assigned to:

- Motor Current
- PI Ref Output
- Motor Speed
- PI FB Output
- Motor Thermal state
- PI Err Output
- Motor Power
- PI Integral Error
- Motor Torque

Logic Outputs

The ALTIVAR 66 drive has 2 logic outputs (LO1 and LO2) and 2 relay outputs (R1 and R2). R1 is fixed as the Fault Relay and cannot be reassigned. LO1, LO2, and R2 can be assigned to indicate:

- Ready State
- Loss of Follower
- Running State
- Frequency Level Attained
- At Speed
- Current Level Attained
- Forward Direction
- Thermal Level Attained
- Reverse Direction
- Jog Enabled
- Terminal/Keypad
- FB Limit (PI FLT Ratio)
- Auto/Manual
- FB High Alarm
- Current Limit
- FB Low Alarm
- Fault State
- Brake Release
- Shutdown Complete
- Run Output Command
- Drive Thermal Alarm (ATV66D16 to C31 drives only)

Factory Settings for Input/Outputs

Logic Inputs	LI1 LI2 LI3 LI4	Run Enable Run Forward Run Reverse Jog	LI3 and LI4 can be reassigned
Analog Inputs	AI1 AI2	Speed Reference 1 Speed Reference 2	AI2 can be programmed to be 0-20 mA, 4-20 mA, x-20 mA or 20-4 mA, or can be set to 0-5 V.
Logic and Relay Outputs	LO1 LO2 R1 R2	At Speed Current Limit Fault Running State	LO1, LO2, and R2 can be reassigned
Analog Outputs	AO1 AO2	Motor speed 20 mA = 120% of high speed Motor current 20 mA = 200% of nominal drive current	AO1 and AO2 can be reassigned

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VW3A66201T

I/O EXTENSION MODULES

An I/O Extension Module can be installed in the ALTIVAR 66 drive to adapt it to a specific application. This module allows the expansion of functionality by increasing the number of inputs and outputs and requires no additional panel space. At first power-up, the additional inputs and outputs on the I/O Extension Module are assigned to factory settings. They can be reassigned with the keypad display.

The VW3A66201T card has four 24 VDC logic inputs, two analog inputs, two relay outputs, and one analog output.

The VW3A66202T card has eight 115 VAC logic inputs, two analog inputs, two relay outputs, and one analog output. An external 115 VAC power supply is required to operate the logic inputs on the VW3A66 202T module. When using the VW3A66 202T module, LI2, LI3 and LI4 on the main control board are ignored.

Both have a PCMCIA connector for addition of optional serial communication. The I/O Extension Module mounts inside the drive with two screws. It has pull-apart terminal strips for easy wiring.

A Communication Carrier Module, VW3A66205, is also available for the ALTIVAR 66 drive. The Communication Carrier Module does not extend AC drive functions, but provides a PCMCIA connection for addition of optional serial communication.

Extensions and Additional Functions

With the I/O Extension Module, additional application functions are available for assignment to the function keys. The I/O Extension Module also extends certain drive functions and allows access to additional supplementary functions.

Extensions to existing drive functions:

- Seven preset speeds
- Bipolar speed reference

Additional drive functions:

- Voltage reduction
- Speed feedback with tachogenerator
- Orient
- Process cycles

Compatibility

Not all application functions can be used at once. The table below shows which functions are compatible.

Read up and across from the ● to identify pairs of incompatible functions. Incompatibilities due to the number of I/O available for reassignment are not shown.	RUN REVERSE	JOG	+/- SPEED	SET POINT MEMORY	PRESET SPEEDS	SPEED REFERENCE	AUTO/MANUAL	CONTROLLED STOP	SHUTDOWN	BYPASS	BRAKE SEQUENCE	MOT. SELECT SWITCH	PI REGULATOR SWITCH	ORIENT	TACHOMETER FEEDBACK	CYCLES	FORCED LOCAL
RUN REVERSE													●				
JOG									●				●				
+/- SPEED				●	●								●			●	
SET POINT MEMORY			●		●		●						●			●	
PRESET SPEEDS			●	●									●			●	
SPEED REFERENCE													●				
AUTO/MANUAL				●									●			●	
CONTROLLED STOP									[1]		●			●			
SHUTDOWN		●						[1]			●		●	●		●	
BYPASS																●	
BRAKE SEQUENCE								●	●				●	●			
MOT. SELECT SWITCH				●				●	●				●			●	
PI REGULATOR SWITCH	●	●	●	●	●	●	●		●		●	●					
ORIENT								●	●		●						
TACHOMETER FEEDBACK																	
CYCLES			●	●	●		●		●	●		●					
FORCED LOCAL																	

[1] Shutdown is incompatible with Controlled Stop by Frequency Threshold and Controlled Stop by Frequency Threshold/Logic Input.

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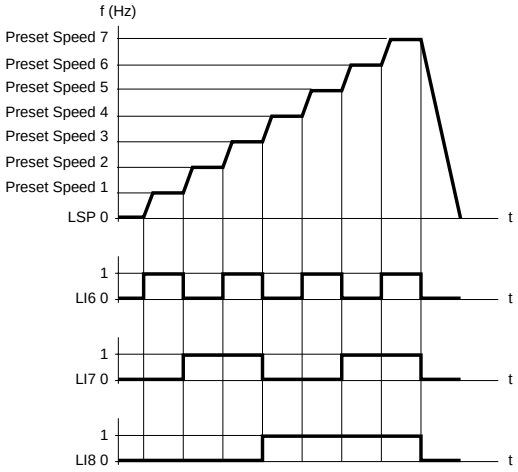
SEVEN PRESET SPEEDS

Function

The I/O Extension Module extends the Preset Speeds function available with the basic drive (see page 27) to allow switching among one, three, or seven preset speeds.

Applications

For material handling and machines which run at several speeds. The figure below gives an example with eight speeds.



An eighth speed is obtained when all three inputs are at state 0. The eighth speed is Low speed or reference speed if there is a signal at AI1 or AI2.

	LIa	LIb	LIc
Low Speed or Reference	0	0	0
Preset Speed 1	1	0	0
Preset Speed 2	0	1	0
Preset Speed 3	1	1	0
Preset Speed 4	0	0	1
Preset Speed 5	1	0	1
Preset Speed 6	0	1	1
Preset Speed 7	1	1	1

Adjustments

The preset speeds are adjustable:

- ATV66U41 to D79 constant torque: 0.1 to 400 Hz
- ATV66C10 to C31 constant torque: 0.1 to 200 Hz
- Variable torque: 0.1 to 72 Hz

Programmed values must increase consecutively from speeds 1 to 8. If all three logic inputs are low, the speed will be the speed reference, if present, or low speed. The factory preset values for seven preset speeds are: 5, 10, 15, 20, 25, 30, and 35 Hz. LI5, LI6, and LI7 are factory set for Preset Speeds; however, Preset Speeds can be assigned to LI3-LI8.

BIPOLAR SPEED REFERENCE

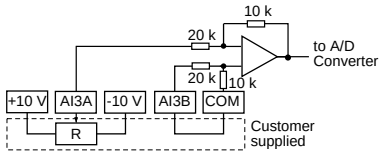
Function

The I/O Extension Module allows extension of the Speed Reference function available with the basic drive (see page 27). It adds the ability to modify the characteristics of the voltage analog input AI3. Factory setting is ±10 V bipolar speed reference. Other values are 0 to +10 V or 0 to -10 V unipolar speed reference. This function also allows modification of the characteristics of the current analog input AI4. The factory setting is 4-20 mA speed reference. Other possible values are 0-20 mA or 20-4 mA speed reference.

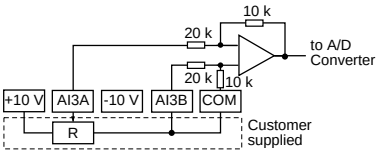
If AI3 or AI4 is assigned as Speed Reference 3, the input is summed with input AI1 and AI2, limited to high speed. However, when Auto/Manual is active, the inputs assigned to Speed Reference 1 and Speed Reference 2 function independently, and only one is active at a time.

When AI3 and AI4 are multiplied by (-1) the signal is subtracted. If Clamp Sum is set to Yes (factory setting) and the result is zero or negative, the controller will run at Low Speed. If Clamp Sum is set to No and the result is negative, the controller output phase sequence will change, causing the motor shaft to change direction. The directional change affects both the forward and reverse inputs, as well as the jog function. If Auto/Manual is active and AI3 is set for bipolar speed reference, negative polarity speed reference values are ignored and the controller will run at Low Speed, regardless of the setting of the clamp sum.

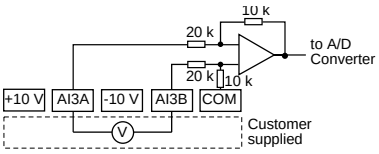
+/- 10 V input referenced to COM



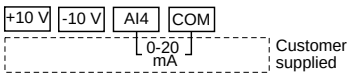
0 to 10 V input referenced to COM



+/- 10 V input not referenced to COM



AI4 input



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Applications

This function is suited to applications where a positive and negative speed from a reference potentiometer or an external speed reference are used, or where three summed speed references are used.

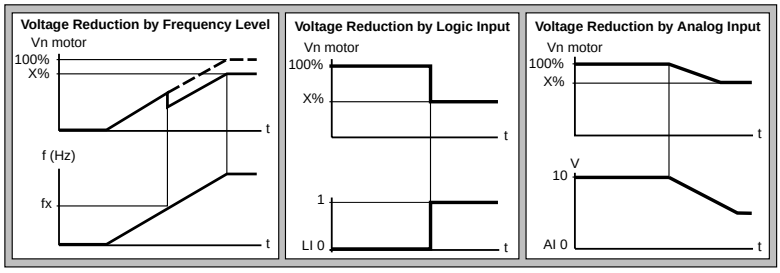
VOLTAGE REDUCTION

Function

Voltage Reduction is available only with the I/O Extension Module. This parameter reduces motor voltage when running at no or low load in either forward or reverse. This reduces magnetism in the motor as well as audible motor noise. The function is activated at a frequency threshold, or by a logic or analog input reassigned to the function. The voltage can be limited to a value between 100 and 20% or nominal motor voltage.

Applications

For constant torque applications only. Useful for reduction of motor losses during continuous duty.

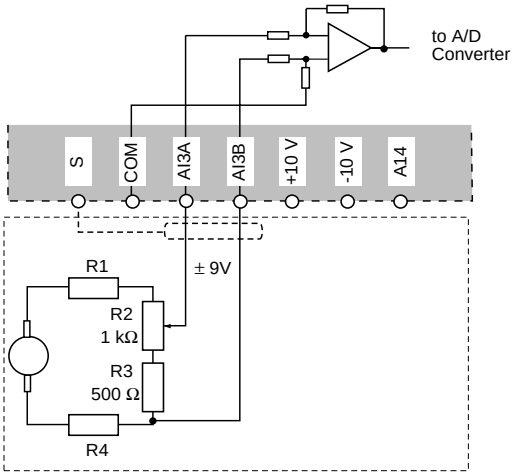


TACHOMETER FEEDBACK

Function

This function is available only with the I/O Extension Module. A tachometer can be connected to AI3 allowing speed feedback. A feedback signal of 9 V corresponds to a maximum frequency of High Speed (HSP). This improves the speed regulation to the accuracy of the tachometer (typically 0.5% of the motor base speed).

Wiring Scheme



The AI3 differential input is used.

A resistor divider network must be provided to obtain a ± 9 V signal corresponding to maximum speed.

Note: Isolation between the input power and the tachogenerator is ensured by the drive.

Applications

Machines requiring constant speed when there are changes in the load.

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ORIENT

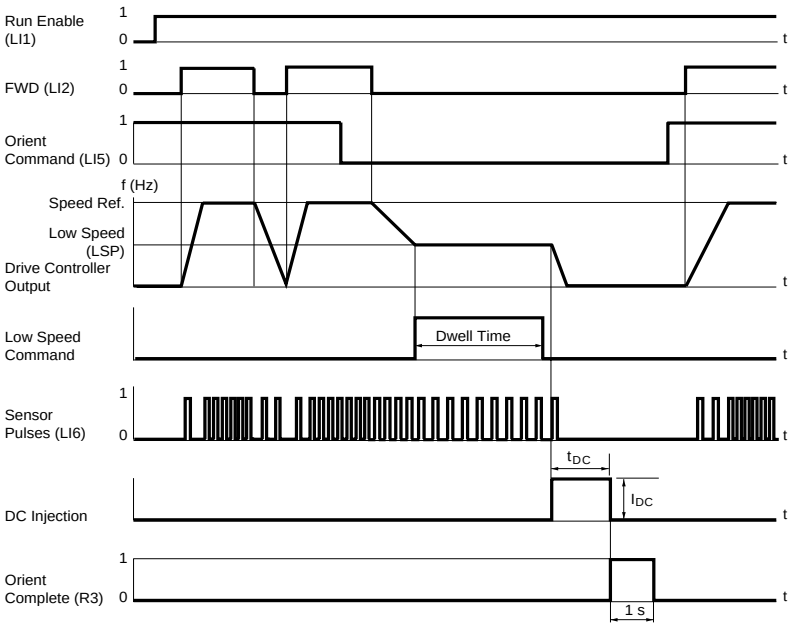
Function

This function is available only with the I/O Extension Module. It is activated by two logic inputs and one logic output, and requires a 3-wire, PNP, normally-open type sensor. Orient allows the drive to start and stop operation at the same rotor position relative to the stator.

Application

Orient is used on machines such as washing machines, centrifuges and mixers for positioning at the end of the cycle.

The figure below shows an example using logic inputs LI5 and LI6, and output R3:



In this example:

- Orient Command is assigned to LI5.
  - — If LI5 is high and a stop is commanded, the AC drive follows its normal stop.
  - — If LI5 goes low, the AC drive follows an Orient stop, decelerating to Low Speed.
- When Low Speed is reached, the AC drive runs at Low Speed for the amount of time set by the Dwell Time parameter.
- At the first sensor pulse received at LI6 (assigned to Pulse Input) after the dwell time, DC is injected at the level, and for the amount of time, adjusted.
- At the end of DC injection, R3 (assigned as the Complete output) changes state for 1 s to indicate that Orient is complete.

Adjustments

Dwell Time, the duration for which the drive dwells at low speed after deceleration, is adjustable from 0 to 10 seconds, factory set for 1 second. DC Injection Time, the duration for which DC is injected at the first sensor pulse after the Dwell Time, is adjustable from 0 to 30.1 seconds, factory set for 5 seconds. DC Injection Level, the current level at which DC is injected, is adjustable from 50 to 150% of nominal motor current, factory set to 50%.

PROCESS CYCLES

Function

Process Cycles is available only with the I/O Extension Module. Process Cycles is a control function that allows sequences of operations to be programmed into the AC drive. Execution of the program sequence can be controlled through the Terminal Command Mode or Keypad Command Mode.

Process Cycles allows up to 8 steps to be programmed. Each step has a defined duration, speed, and ramp time. One step can consist of several substeps (subcycles), defined with only 1 ramp time and 1 speed. When operated from the Terminal Command Mode, Process Cycles requires 3 logic inputs. A fourth logic input can be assigned to Step Locking, and 2 logic outputs can be assigned to indicate Cycle Complete and Cycle Fault. It is also possible to operate Process Cycles in the Keypad Command Mode. Up to 3 keypad function keys may be assigned to Start Cycle (SCY), Reset Cycle (RCY), and Next Step (NCY), respectively. Step Locking is not available when operating in the Keypad Command Mode.

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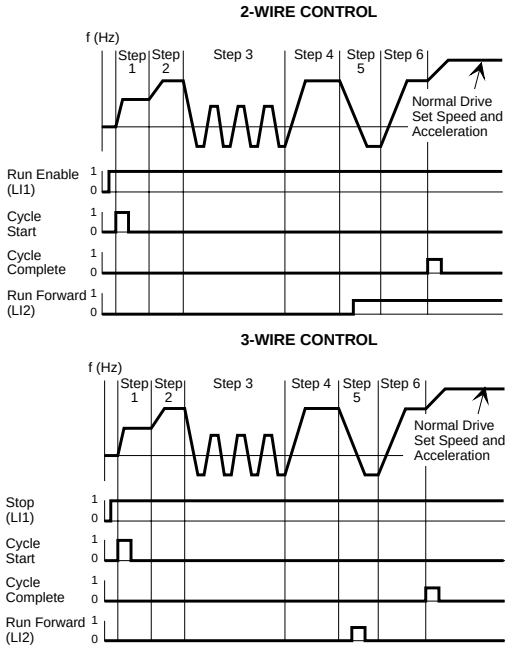
Example: Complete Cycle



Step 1	When the logic input assigned to Start Cycle goes high for at least 200 ms, the cycle starts. The AC drive accelerates (Step 1 ramp) to the Step 1 frequency. It runs at that frequency for the duration specified by the Step Time parameter (minus the acceleration ramp time).
Step 2	When Step Time 1 expires, the AC drive ramps to the Step 2 frequency and direction.
Step 3	The AC drive ramps to the Step 3 frequency and direction, then changes direction. The direction change repeats for the specified number of subcycles.
Step 4	The AC drive ramps to the Step 4 frequency and direction.
Step 5	The AC drive ramps to the Step 5 frequency and direction. A Run Forward command is activated. The AC drive completes Step 5 before returning to normal operation after Step 6.
Step 6	The AC drive ramps to the Step 6 frequency and direction. When Step 6 is completed, the Cycle Complete logic output goes high for 200 ms. The AC drive ramps to the Terminal Command Mode Speed Reference and direction (as commanded by Run Forward in Step 5).

Applications

Process Cycles applications include industrial washing machines and mixers.

FACTORY SETTINGS OF INPUTS/ OUTPUTS WITH I/O EXTENSION MODULE

When a drive configured with an I/O Extension Module is first powered up, the associated inputs/ outputs are automatically configured as follows:

Input	**Factory Settings**
AI3	Speed Reference 3
AI4	Not Assigned
LI5	7 Preset Speeds
LI6	
LI7	
LI8	Fault Reset
Output	**Factory Settings**
AO3	Motor Power
R3	Thermal Level 1
R4	Ready State

The factory settings of the drive inputs and outputs are not modified by the use of an I/O Extension Module. Reconfiguration of all inputs and outputs is possible with the keypad display.

OUTPUT ASSIGNMENTS WITH I/O EXTENSION MODULE

The supplementary assignments of the logic outputs available with the I/O Extension Module are as follows:

Frequency Level 2	Changes from state 0 to state 1 when motor speed attains a second value.
Current Level 2	Changes from state 0 to state 1 when motor current attains a second value.
Thermal Level 2	Changes from state 0 to state 1 when motor thermal state attains a second value.
Ramp not Followed	Changes from state 0 to state 1 when the acceleration or deceleration does not follow the adjusted ramp (used with tachogenerator feedback).
Overspeed	Changes from state 0 to state 1 when the drive output frequency is greater than 20% of the set maximum frequency for 250 ms.
Feedback Loss	Changes from state 0 to state 1 when the difference between reference frequency and the feedback is greater than 10% (used with tachogenerator feedback).

FAULT CONFIGURATION WITH I/O EXTENSION MODULE

The I/O Extension module allows you to assign a logic input to a user-defined fault (i.e., a fault specific to an installation). The logic input can be programmed to detect the fault when at state 1 or state 0. Fault stopping method is also programmable.

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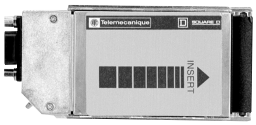
COMMUNICATION OPTIONS

The communication options for the ATV66 are designed for ease of installation and configuration. They have also been designed such that they can be added without taking additional panel space. Installation is quick and easy. There are no chips to replace or dip switches to set. Address and configuration selections are made via the keypad. Menu selections provide adjustment value to select from, reducing configuration time.

The following protocols are available for use with the entire ATV66 family of drives:

- MODBUS® RTU/JBUS
- MODBUS ASCII
- UNI-TELWAY™
- MODBUS Plus

Two PCMCIA Communication Card Kits are available for connecting ALTIVAR 66 AC drives to multipoint networks:



- VW3A66301U UNI-TELWAY, MODBUS Communication Card Kit
- VW3A66305U MODBUS Plus PCMCIA Communication Card Kit

The VW3A66301U Kit allows you to connect an ALTIVAR 66 AC drive to multipoint networks using UNI-TELWAY, MODBUS RTU/JBUS and MODBUS ASCII protocols. The VW3A66305U MODBUS Plus Kit allows you to connect an ALTIVAR drive to multipoint networks using MODBUS Plus protocol and take advantage of the exclusive peer cop feature. Peer cop reduces programming by directly mapping memory locations between the PLC and the drive.

Function

As a node on a network, the ALTIVAR 66 AC drive can receive and respond to data messages. This data exchange allows your network to access ALTIVAR 66 functions such as:

- Downloading of adjustment parameters
- Command/control
- Monitoring
- Diagnostics

The communication card kit contains a Type 3 Personal Computer Memory Card International Association (PCMCIA) card. The PCMCIA card slides into a slot on the following modules.

The ATV66 drive must be equipped with one of the following option modules:

- I/O Extension Module VW3A66201T (24 VDC)
- I/O Extension Module VW3A66202T (115 VAC)
- Communications Carrier Module VW3A66205

Unless the application requires additional hardwired I/O, the communications carrier module is the recommend module. The PCMCIA card slides into the communications carrier or I/O extension module which is installed on the ALTIVAR 66 drive without taking additional panel space.

Applications

Applications requiring networked drives and access to critical information.

Access to critical information

The communications option allows high speed access to 13 adjustment parameters, 28 command and control parameters, 123 monitoring parameters, and 19 diagnostic parameters.

Adjustments

Protocol selection and assignment of address.

11- COMMUNICATION	
ADDRESS	: 0
PROTOCOL	: ---
TRAN.SPEED	: 9.6
FORMAT	:8B,1 stoP
PARITY	: ODD

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Command/Control Registers

Address	Bit	Description
Wnnn	0 1 2 3 4 5	Drive reset Assignment of logic commands over link (DLI) Assignment of references over link (FLI) Alternate ramps (Ramp 2) Suppression of communication control (No time out) Run/Stop command
	6 7 8 9	Braking by DC injection (DCB) Orient Stop Freewheel stop Fast stop
	10	Command of voltage reduction
	11 12	Multi-motors Multi-parameters
	14	External fault command
Wnnn	—	Reference frequency
Wnnn	1 – 2, 6 – 8	Command of LOx / ROx state
Wnnn	—	Command of AO1 level
Wnnn		Current limit level
Wnnn		Motoring torque limit level
Wnnn		Regenerating torque limit level
Wnnn		Voltage reduction level
Wnnn	—	Command of AO2 level
Wnnn	—	Command of AO3 level
Wnnn	0	Command of current limit
	1	Run direction
	3	Command of torque limit
	8	Elapsed timer reset

Adjustment Registers

Address	Bit	Description
Wnnn	—	High speed
Wnnn	—	Low speed
Wnnn	—	Accel 1
Wnnn	—	Decel 1
Wnnn	—	Accel 2
Wnnn	—	Decel 2
Wnnn	—	Slip compensation
Wnnn	—	IR compensation
Wnnn	—	Profile
Wnnn	—	Voltage boost
Wnnn	—	Damping
Wnnn	—	Bandwidth
Wnnn	—	Motor overload

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Monitoring Registers

Address	Bit	Description
Wnnn	0	Command mode of drive
	1	AC drive ready (RDY or SLC)
	2	Fault (FLT)
	3	Reset authorized
	4	Brake engage relay state
	5	Forced local
	6	NTO
	7	Resettable fault
	8	Motor running
	9	Actual rotation direction
	10	DC injection braking
	11	Steady state
	12	Motor thermal overload alarm
	14	Current limit
	15	No line power (NLP)
Wnnn	—	Output frequency
Wnnn	—	Output current
Wnnn	1 – 8	Display of logic input activation (LI1 – LI8)
	9 – 10	Display of logic output activation (LO1 – LO2)
	11 – 14	Display of relay activation (R1 – R4)
Wnnn	—	Value of analog input (AI1)
Wnnn	—	Motor torque
Wnnn	—	Speed reference
Wnnn	0	Local command mode T/K
	1	Logic commands over link (DLI)
	2	Reference commands over link (FLI)
	3	Dynamic braking
	4	Fast stop
	5	Power loss, ramp stop
	6	Gating state
	7	Orient complete
	8	Deceleration (DEC)
	9	Acceleration (ACC)
	10	Multi-motor or
	11	Multi-parameter selected
	13	AC drive thermal fault
	14	Torque limit
	15	Stopping by the keypad
Wnnn	0	Jog
	1	Shutdown complete
	2	Cycle complete
	3	Alternate ramp
	4	Auto/Manual
	5	Frequency level 1 attained
	6	Frequency level 2 attained
	7	Current level 1attained
	8	Current level 2 attained
	9	Thermal level 1attained
	10	Thermal level 2 attained
	11	No ramp follow
	12	Run output command (bypass)
	13	Rotation direction
Wnnn	—	Output power
Wnnn	—	Output voltage
Wnnn	—	Line voltage
Wnnn	—	Bus voltage
Wnnn	—	Motor thermal state value
Wnnn	—	AC drive thermal state value
Wnnn	—	Elapsed time (hours)
Wnnn	—	Elapsed time (minutes)
Wnnn	—	Output speed (rpm)
Wnnn	—	Machine frequency reference (customer units)
Wnnn	—	Machine frequency (customer units)
Wnnn	—	Value of analog input AI2
Wnnn	—	Value of analog input AI3
Wnnn	—	Value of analog input AI4

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Monitoring Registers (Continued)

Address	Bit	Description
Wnnn	—	Value of AO1
Wnnn	—	Value of AO2
Wnnn	—	Value of AO3
Wnnn	—	Speed ramp output
Wnnn	—	Nominal motor voltage range
Wnnn	—	Number of motor or parameter set selected
Wnnn	—	Cycles step number in progress
Wnnn	—	Preset speed number in progress
Wnnn	—	Assignment of AI1
Wnnn	—	Assignment of AI2
Wnnn	—	Assignment of AI3
Wnnn	—	Assignment of AI4
Wnnn	—	Assignment of analog output AO1
Wnnn	—	Assignment of analog output AO2
Wnnn	—	Assignment of analog output AO3
Wnnn	—	Assignment of LO1
Wnnn	—	Assignment of LO2
Wnnn	—	Assignment of R1
Wnnn	—	Assignment of R2
Wnnn	—	Assignment of R3
Wnnn	—	Assignment of R4
Wnnn	—	Assignment of LI1
Wnnn	—	Assignment of LI2
Wnnn	—	Assignment of LI3
Wnnn	—	Assignment of LI4
Wnnn	—	Assignment of LI5
Wnnn	—	Assignment of LI6
Wnnn	—	Assignment of LI7
Wnnn	—	Assignment of LI8
Wnnn	—	AC drive horsepower (hardware rating)
Wnnn	—	AC drive horsepower (configured rating)
Wnnn	—	AC drive voltage range
Wnnn	—	Line frequency recognized
Wnnn	—	AC drive maximum rated frequency
Wnnn	—	AC drive nominal current
Wnnn	—	AC drive maximum current
Wnnn	—	Memory card option
Wnnn	—	Communication carrier option
Wnnn	—	Presence of keypad
Wnnn	—	I/O Extension option card
Wnnn	—	PCMCIA communication card
Wnnn	—	State of command node
Wnnn	—	Token rotation time
Wnnn	—	Token count
Wnnn	—	Messages received

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Diagnostic Registers

Address	Bit	Description
Wnnn	0 4 5	Drive faulted, stopped State of Adjustment Semaphore State of Command Semaphore
Wnnn	—	Display of fault causing trip
Wnnn	—	Display of present faults
Wnnn	—	Indicates the position of marker on 1 of 8 past faults
Wnnn	—	Past fault 1: AC drive state
Wnnn	—	Past fault 1: name of fault
Wnnn	—	Past fault 2: AC drive state
Wnnn	—	Past fault 2: name of fault
Wnnn	—	Past fault 3: AC drive state
Wnnn	—	Past fault 3: name of fault
Wnnn	—	Past fault 4: AC drive state
Wnnn	—	Past fault 4: name of fault
Wnnn	—	Past fault 5: AC drive state
Wnnn	—	Past fault 5: name of fault
Wnnn	—	Past fault 6: AC drive state
Wnnn	—	Past fault 6: name of fault
Wnnn	—	Past fault 7: AC drive state
Wnnn	—	Past fault 7: name of fault
Wnnn	—	Past fault 8: AC drive state
Wnnn	—	Past fault 8: name of fault

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MODBUS PLUS OVERVIEW

MODBUS Plus (MB+) is a synchronous network that achieves peer-to-peer access through token passing. The token rotation is a logical ring sequence, with the node holding the token passing it to the next highest node address on the network (local network section only -- i.e. the token does not cross a bridge boundary). When a node holds the token, it may initiate point-to-point messages on the link, gather network statistics, generate specific transfers, etc.

Network nodes are identified by addresses assigned by the user. Each node's address is independent of its physical site location. Addresses are within the range of 1... 64 decimal, and do not have to be sequential.

While holding the token, a node initiates message transactions with other nodes. Each message contains routing fields that define its source and destination, including its routing path through bridges to a node on a remote network ring. When passing the token, a node can write into a global database that is broadcast to all nodes on the local network ring. Global data is transmitted as a field within the token frame. A PLC can extract global data and use this information for control decisions. Use of the global database allows rapid updating of alarms, setpoints, and other data. Each network maintains its own global database, as the token is not passed through a bridge to another network ring.

Peer Cop Capability

The MODBUS Plus communications option is designed to take advantage of the MODBUS Plus Peer Cop capability. **This is an exclusive feature not found with other drives using MODBUS Plus communications**. This can eliminate ladder logic programming and improves register update time significantly. Each command node can send up to 32 words of peer cop data. This allows mapping of the most commonly used command and adjustment registers.

Peer Cop is the mechanism, or capability, to automatically map, or assign, a set of registers from one node on the network to another. The MODBUS Plus network supports specific transfers to enable this capability. Global data may be peer-copped as well. A specific transfer is a data transfer that sends data from one specific node to another specific node on the same network. In many ways this data resembles the global data in that a transmitting node sends it once every token rotation, and without first encapsulating it in a MODBUS Command. The peer cop data is always sent in the token frame however, and specific transfer data is sent as a separate frame, or series of frames, just prior to the release of the token. Each drive can send up to 32 words of specific data to the PLC on the network ring, as long as the total number of words does not exceed 500, prior to releasing the token.

Global Data Transmission

The MODBUS Plus Global Data Transmission capability allows 32 display registers of the ALTIVAR 66 drive to be broadcast to the PLC. Parameters such as fault status, output frequency, and output current can be read by other PLCs on the network ring. Monitoring of the drive status has never been easier. Each drive sends its global data to all other PLCs on the network when it passes the token. If the drive is not configured to send global data then no data is sent with the token.

Messaging

The Modicon MSTR Block function can be used to communicate with the ALTIVAR 66 drive. As a node on the network, the ALTIVAR 66 can respond to a messaged request from a device such as a PLC or an MMI. All adjustment and command parameters can be read or written. Display and diagnostic parameters can be read. Messaging is achieved on MODBUS Plus via MODBUS Commands. This application layer command structure is the same as that used on MODBUS (see Modicon MODBUS Protocol Reference Guide, PI-MBUS-300). In addition, several new commands are defined for gathering network statistics, etc.

Each MODBUS Command follows a Query-Response model. The initiating node sends a query to a specific node, and receives a response. When MODBUS Commands are issued over MODBUS Plus, the solicited node must send an immediate acknowledgment. When the solicited node holds the token, it may then send any data that was requested to the requesting node.

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PARAMETER SUMMARY

The tables on pages 46 to 52 summarize the parameters accessible from the 11 menus available on the ALTIVAR 66 drive along with their ranges and factory settings.

NOTE: Parameters available only with the I/O Extension Module are shaded.

Parameter Setting

Parameter	Range	Factory Setting	Description
Low Speed	0–High Speed	0 Hz	Low speed setting.
High Speed	Low Speed to Maximum Frequency	50 Hz if input freq. is 50 Hz; 60 Hz if input freq. is 60 Hz	High speed setting.
Acceleration	0.1–999.9 s	3 s	Length of time to accelerate from zero speed to nominal frequency.
Deceleration	0.1–999.9 s	3 s	Length of time to decelerate from nominal frequency to zero speed.
Acceleration 2	0.1–999.9 s	5 s	Second acceleration ramp rate, used when alternate ramp is selected (7.12→Control Parameters menu).
Deceleration 2	0.1–999.9 s	5 s	Second deceleration ramp rate, used when alternate ramp is selected (7.12→Control Parameters menu).
Slip Compensation	0.1–10 Hz	Depends on AC drive horsepower	Improves steady state speed regulation by controlling output frequency based on motor slip. Only available with constant torque configuration and when set to Manual in the 7.11→Motor Parameters menu.
IR Compensation	Normal: 0–100% High Torque: 0–150% Special: 0–800%	100%	Used to adjust low speed torque for optimal performance. For constant torque only.
Damping	Normal, High Torque (CT), & NOLD (VT): 1–100%; Special (CT) and Normal (VT): 1–800%	20%	Matches the response of the load to the frequency response of the AC drive by adjusting the integral gain of the frequency loop.
Profile	0–100	20	Shapes the V/Hz profile of the output for variable torque applications in normal control type.
Bandwidth	0–100%	20%	Second frequency loop gain when AC drive is set for constant torque, high torque control type.
Voltage Boost	0–100% of nominal voltage	20%	Corresponds to a voltage level at 0 Hz, allowing for optimal voltage and torque boost during starting in special and high torque control types.
Motor Overload	0.45–1.15 times nominal AC drive current	0.9 x nominal AC drive current	Accounts for speed, time and current when calculating thermal overload state.
SP Gain	-9999 to +9999	+9999	System gain in PI Regulator
Offset	-9999 to +9999	+0	System offset in PI Regulator
KP	0–9999	100%	Proportional gain in PI Regulator
KI	0–9999	0	Integral gain in PI Regulator
PI FLT Ratio	0–100%	100%	Limitation of error between desired setpoint and actual process feedback
PI Set Point	-9999 to +9999	0	Setpoint in PI Regulator
PI SP Manual	0–High Speed	0 Hz	Manual speed reference in PI Regulator

Logic Input Map

Logic Input	Factory Setting	Reassignable
LI1	Run permissive	No
LI2	Run forward	No
LI3	Run reverse	Yes
LI4	Jog	Yes
LI5	Seven Preset Speeds	Yes
LI6		Yes
LI7		Yes
LI8	Fault Reset	Yes

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Analog Input Map

Analog Input	Factory Setting	Reassignable
AI1	Speed reference1	No
AI2	Speed reference 2	Yes
AI3	Speed reference 3	Yes
AI4	Not assigned	Yes

Logic Output Map

Logic Output	Factory Setting	Reassignable
LO1	At speed	Yes
LO2	Current limit	Yes
R1	Fault	No
R2	Running state	Yes
R3	Thermal Level 1	Yes
R4	Ready State	Yes

Analog Output Map

Analog Output	Factory Setting	Reassignable
AO1	Motor speed	Yes
AO2	Motor current	Yes
AO3	Motor power	Yes

NOTE: Parameters available only with the I/O Extension Module are shaded.

Display Configuration

Selection	Factory Setting
One Bar Graph, Scroll	One Bar Graph
Two Bar Graphs, Scroll	
4 Tables, Scroll	

Keypad Configuration

Selection	Factory Setting
Terminal Command	Terminal Command
Keypad Command	
Ter/Key by LI	
Ter/Key by F2	
Program Function keys	

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Display Mode Status Codes

Code	Definition	Code	Definition
NLP	No Line Power (control power supplied separately)	CLI	Current Limit
RDY	Drive Ready	DCB	DC Injection Braking
RUN	Drive Running (at speed)	JOG	Jogging
	Forward Direction	NRP	No Run Permissive (LI1 open)
	Reverse Direction	BRK	Braking
ACC	Accelerating	SLC	Serial LInk Command
DEC	Deceleration	FLT	Fault

Drive Configuration

Parameter	Range	Factory Setting	Description
Torque Type	Constant Variable Variable Low Noise	Constant	Type of Torque.
Command Type	2-wire (maintained) 3-wire (impulse)	2-wire	Type of control circuit which is wired into the AC drive, affecting operation of the Forward and Reverse inputs.
Motor Power (ATV66U41 only)	.75 kW / 1 hp 1.5 kW / 2 hp 2.2 kW / 3 hp	2.2 kW / 3 hp	Used to select motor power for ATV66U41 AC drive.

General Configuration: Motor Parameters

Parameter	Range	Factory Setting	Description
Nominal Current	45–105% of AC drive current rating	90%	Motor nameplate value for full load current.
Nominal Frequency	50 Hz, 60 Hz Special: ATV66U41–D79, CT: 25–400 Hz; ATV66C10–C31, CT: 25–200 Hz; VT: 25–90 Hz	60 Hz if input freq. at 1st power up = 60 Hz 50 Hz if input freq. at 1st power up = 50 Hz	Point on the V/Hz curve beyond which voltage remains virtually constant and only frequency increases.
Nominal Voltage	ATV66•••N4: 380- 400- 415- 440- 460 V	ATV66•••N4: 400 V if input freq. at 1st power up = 50 Hz; 460 V if input freq. at 1st power up = 60 Hz	Point on the V/Hz curve beyond which voltage remains virtually constant and only frequency increases.
	ATV66•••M2: 208- 220- 230- 240 V	ATV66•••M2: 230 V	
IR Compensation	Normal: 0–100% High Torque: 0–150% Special: 0–800%	100%	Used to adjust low speed torque for optimal performance. For constant torque only.
Voltage Boost	0–100% of nominal voltage	20%	Corresponds to a voltage level at 0 Hz, allowing for optimal voltage and torque boost during starting in special and high torque control type.
Profile	0–100	20	Shapes the V/Hz profile of the output for variable torque applications in normal control type.
Damping	Normal, High Torque (CT) and NOLD (VT): 1–100%; Special (CT) and Normal (VT): 1-800%	20%	Matches the response of the load to the frequency response of the AC drive by adjusting the integral gain of the frequency loop.
Bandwidth	0–100%	20%	Second frequency loop gain when AC drive is set for constant torque, high torque control type.
Rotation Normalization	ABC, ACB	ABC	Inverts direction of motor rotation without rewiring.
Torque Limit Generator	0–200% of nominal motor torque	150%	Allows the limitation of torque, independent of current limit, in the generator quadrant (AC drive with dynamic braking).
Torque Limit Motor	0–200% of nominal motor torque	150%	Allows the limitation of torque, independent of current limit, in the motor quadrant.

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General Configuration: Motor Parameters

Parameter	Range	Factory Setting	Description
Current Limit	Default limit, Alternate value, CT: 40–150% of nominal drive AC drive current if input freq. = 60 Hz, 40–150% of nominal AC drive current if input freq. = 50 Hz VT: 40–110% of nominal drive AC drive current By frequency level CT, ATV66U41–D79: 0.1–400 Hz CT, ATV66C10–C31: 0.1–200 Hz VT: 0.1–90 Hz	CT: 150% if input freq. = 60 Hz; 136% if input freq. = 50 Hz VT: 110%	Allows alternate current limit value by frequency level, logic input or analog input.
Slip Compensation	No, Automatic, Manual: 0.1–10 Hz	Automatic	Improves steady state speed regulation by controlling output frequency based on motor slip. Only available with constant torque configuration.
Brake Sequence		Allows sequencing of AC drive output, mechanical brake actuation, and DC injection for smooth starting and stopping.	
Release Frequency	0 Hz–Low Speed	0 Hz	Release frequency and release current must be reached before the brake output changes state.
Release Current	0–100% of motor nominal current	0%	Release current and release frequency must be reached before the brake output changes state.
Release Time	0–5 s	0 s	Delay between when brake output changes state and AC drive begins its acceleration ramp.
Engage Frequency	0 Hz–Low Speed	0 Hz	Frequency at which, after a stop command is received and the AC drive decelerates, DC injection braking is activated.
Engage Time	0 to 5 s	0 s	Delay between when Engage frequency is reached and DC is injected, and when brake output changes state initiating brake actuation.
DC Injection Level	50–150% of motor nominal current	70%	Level of DC injection braking current.
DC Brake Time	0–30.1 s	2 s	Amount of time for which DC is injected.

General Configuration: Control Parameters

Parameter	Range	Factory Setting	Description
Maximum Frequency	CT, ATV66U41–D79: Nominal Freq.–400 Hz CT, ATV66C10–C31: Nominal Freq. –200 Hz VT: Nominal Freq.–90 Hz	60 Hz if input line freq. = 50 Hz; 72 Hz if input line freq. = 60 Hz	Maximum output frequency.
Low Speed	0–High Speed	0 Hz	Low speed setting.
High Speed	Low Speed to Maximum Frequency	50 Hz if input freq. = 50 Hz; 60 Hz if input freq. = 60 Hz	High speed setting.
Acceleration	0.1– 999.9 s	3 s	Length of time to accelerate from zero speed to nominal frequency.
Deceleration	0.1– 999.9 s	3 s	Length of time to decelerate from nominal frequency to zero.
Acceleration Type	Linear, S, U	Linear	Type of acceleration ramp the AC drive follows.
Deceleration Type	Linear, S, U	Linear	Type of deceleration ramp the AC drive follows.
Alternate Ramps	No, By Frequency level, CT, ATV66U41–D79: 0.1–400 Hz CT, ATV66C10–C31: 0.1–200 Hz VT: 0.1–90 Hz By Logic input Acceleration 2: 0.1– 999.9 s Deceleration 2: 0.1–999.9 s	No 5 s 5 s	Alternate acceleration and deceleration ramps activated by either a frequency level or logic input.

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General Configuration: Control Parameters

Parameter	Range	Factory Setting	Description
Skip Frequencies	Low speed to: CT, ATV66U41–D79: 400 Hz CT, ATV66C10–C31: 200 Hz VT: 90 Hz Skip bands: 2 or 5 Hz	None	AC drive reference will not stop on the skip frequency which causes mechanical resonance. Up to 3 can be programmed.
Voltage Reduction	No, 100%-20%	No	Allows reduction of motor voltage when running at no or low load in either forward or reverse.

NOTE: Parameters available only with the I/O Extension Module are shaded.

General Configuration: Control Type

Control Type	Range	Factory Setting
Constant Torque	Normal, Special motors, High torque (SVC)	Normal
Variable Torque	Normal, NOLD	Normal

Application Functions

Parameter	Range	Factory Setting	Description
Run Reverse	No Yes, Logic input	Yes, Logic Input LI3	AC drive runs in reverse when assigned input is high.
Jog	No Yes, Logic input Jog speed: 0.2–10 Hz Duty time: 0.2–10 s	Yes, Logic Input LI4 5 Hz 0.5 s	AC drive jogs at programmed jog speed when assigned input is high.
+/- Speed	No Yes, with memory Yes, without memory	No	Increase or decrease of the speed by using two logic inputs, similar to a motorized potentiometer. When input assigned to + speed is high, frequency increases according to acceleration ramp, limited by the reference frequency. When input goes low, speed is maintained. When input assigned to -speed is high, frequency decreases according to deceleration ramp, limited by low speed. When input goes low, speed is maintained. With memory: AC drive stores speed. Without memory: Last speed is not stored.
Set Point Memory	No Yes, logic input	No	When the assigned logic input goes high for longer than 0.1 s, the analog speed reference is stored and the AC drive runs at that speed until the next time the input goes high.

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Application Functions

Parameter	Range	Factory Setting	Description
Preset Speeds	No 1 Preset speed 3 Preset speeds 7 Preset speeds Range: 0.1 Hz to: CT, ATV66U41–D79: 400 Hz CT, ATV66C10–C31: 200 Hz; VT: 90 Hz	7 Preset speeds (When preset speeds are selected, factory settings are 5, 10, 15, 20, 25, 30, 35 Hz)	AC drive runs at preset speed depending on settings of assigned logic inputs.
Reference Speed	0–20 mA 4–20 mA 20–4 mA x–20 mA	4–20 mA	Modification of AI2 for the type of signal.
Auto/Manual	No Yes, Logic input	No	Allows switching between AI1 and AI2 by logic command. AI1 is manual reference. AI2 is automatic.
Tach. Feedback	No Tach. FBK. IN:	No	Provides improved speed regulation by using feedback from a user-supplied ±9 V tachogenerator.
Controlled Stop	No By Logic input By Frequency level or by LI / Frequency level CT, ATV66U41–D79: 0.1–400 Hz CT, ATV66C10–C31: 0.1–200 Hz VT: 0.1–90 Hz Stopping Methods: Freewheel stop Fast stop DC injection	No Freewheel stop	Allows frequency threshold and Logic Input to work together to tailor the stopping process.
Orient	No, Yes, Define I/O Dwell time: 0-10 s DC injection time: 0-30 s DC injection level: 50-150% of nominal motor current	No 1 s 5 s 50%	A positioning function that allows the AC drive to start and stop operation at the same rotor position relative to the stator.
Shutdown	No Yes Dwell time: 0.1–60 s	No 1 s	Allows AC drive to dwell at low speed before completely stopping. Time adjustable between 1 and 30 s
Bypass	No Yes, Define I/O Delay time: 0.2–10 s Sequence Time-out Fault: 0.2–300 s Process Time-out Fault: 0.2–300 s	No 2 s 5 s 5 s	Used to run machine at full speed when the drive must be taken off line for service or repair. Allows for isolation of the motor by means of a contactor installed between the drive and the motor with a special command sequence.
Process Cycles	No, Yes, Define I/O Define Step	No	For programming sequences of operations. Each sequence can be programmed with a specific acceleration/deceleration time, direction, set speed, and duration.
Mot. Select Switch	1 Motor 2 Motors 2 Parameters 3 Motors 3 Parameters	1 Motor	2 Motors and 3 Motors used to toggle between sets of motor and control parameters for using two or three motors with a single AC drive. 2 Parameters and 3 Parameters only toggle control parameters, and are for use with one motor.
PI Regulator	No Yes, Set Point Feed Back Set Point Manual PI Parameters	No	Used for controlling level or flow of a process with setpoint and feedback inputs.
Forced Local	No Yes, Logic Input	No	Used to return control to the terminal strip or keypad if in serial link (communication) mode.

NOTE: Parameters available only with the I/O Extension Module are shaded.

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Fault History

Fault Designation	Description
IN-PHASE LOSS	Input Phase Loss: Loss of power or blown fuses. A brief loss of input supply phase (≤ 200 ms) is not detected
UNDERVOLTAGE	Undervoltage: Input voltage to power supply too low or temporary voltage drop
AC-LIN.OVERVOL.	AC line overvoltage: Input voltage to power supply too high
DRIVE OVERTEMP.	Drive overtemperature: heat sink temperature too high
MOT. OVERLOAD	Motor overload: Thermal trip because of prolonged overload, running in single phase on the output, or motor power rating too low for the application
LOSS FOLLOWER	Loss of follower: Loss of the 4-20 mA or 20-4 mA reference at AI2 input
OUT. PHASE LOSS	Loss of an output phase
DC-BUS OVERVOL.	DC bus overvoltage or overcurrent due to excessive braking or overhauling load
SHORT CIRCUIT or SHORT CIRCUIT.	Short circuit between phases or on the output of AC drive
GROUND FAULT	Ground fault: short circuit to earth on the output of the AC drive
PRECHARGE FAIL	Precharge failure: capacitor precharge relay fault
INTERNAL FAULT	Internal fault or missing connection on CL1 and CL2
MEMORY FAILURE	Error in storing to EEPROM
SERIAL LINK	Bad connection of keypad display or communication fault on serial link
AUTO-TEST FAIL	Main control board failure
OVERSPEED	Without a tachometer, fault occurs when output frequency is 20% above Maximum Frequency for 250 ms.
SEQUENCE T. OUT	Sequence time-out: sequence input not received after Run command within programmed time. Used with Bypass function.
PROCESS TIME OUT	Process time-out: process input not received after Run command within programmed time. Used with Bypass function.
DYNAMIC BRAKE	Dynamic brake resistor lost or connection open.
DB RESISTOR	Thermal overload of braking resistor.
TRANS. SHORT C. or GF	Short circuit in transistor
OPEN TRANSISTOR	Transistor has failed open
CONTROL SUPPLY	CL1/CL2 not connected. Only recognized upon power-up.
--No Fault--	No fault recorded
CUSTOM. FAULT	Customer-defined fault

NOTE: Parameters available only with the I/O Extension Module are shaded.

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460 V AC DRIVES

The following tables show power and current ratings for 460 V AC drives when set for constant torque (Table 1); variable torque (Table 2); and variable torque, low noise (Table 3). For 230 V AC drives, see page 56.

Table 1: Constant Torque AC drive Ratings 460 V

400 V ±15% and 460 V ±15%, 50/60 Hz ±5%
Switching Frequency: ATV66U41N4 to D46N4 = 4 kHz, ATV66D54N4 to C31N41 = 2 kHz

Motor Power		Output Current	Max. Transient Current (60 s)	Total Dissipated Power	AC Drive Catalog No.
400 V 50 Hz	460 V 60 Hz				
kw	hp	A	A	W	
0.75 — 1.5 — 2.2 —	— 1 — 2 — 3	2.3 1.8 4.1 3.4 5.8 4.8	3.2 2.7 5.6 5.1 8.0 7.2	95.0 95.0 117 117 140 140	ATV66U41N4
3.0	—	7.8	10.7	165	ATV66U54N4
4.0 —	— 5	10.5 7.6	14.2 11.4	185	ATV66U72N4
5.5 —	— 7.5	13 11	17.7 16.5	225	ATV66U90N4
7.5 —	— 10	17.6 14.0	24.0 21.0	290	ATV66D12N4
11.0 —	— 15	24.2 21.0	33.0 31.5	380	ATV66D16N4
15.0 —	— 20	33.0 27.0	45.0 40.5	530	ATV66D23N4
22.0 —	— 30	48.4 40.0	66.0 60.0	655	ATV66D33N4
30.0 —	— 40	66.0 52.0	90.0 78.0	880	ATV66D46N4
37.0 —	— 50	79.2 65.0	108 97.5	885	ATV66D54N4
45.0 —	— 60	93.5 77.0	127.5 115.5	1055	ATV66D64N4
55.0 —	— 75	115.5 96.0	157.5 144.0	1270	ATV66D79N4
75 —	— 100	152 124	207 186	1605	ATV66C10N4
90 —	— 125	190 156	258 234	1952	ATV66C13N4
110 —	— 150	226 180	307 270	2251	ATV66C15N4
132 —	— 200	270 240	367 360	3067	ATV66C19N4
160 —	— 250	330 300	450 450	4483	ATV66C23N41
200 —	— 300	407 360	555 540	5246	ATV66C28N41
220 —	— 350	449 420	612 630	5966	ATV66C31N41

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Table 2: Variable Torque AC Drive Ratings 460 V

400 V ±15% and 460 V ±15%, 50/60 Hz ±5%
Switching Frequency: ATV66U41N4 to D46N4 = 4 kHz, ATV66D54N4 to C31N41 = 2 kHz

Motor Power		Output Current	Max. Transient Current (60 s)	Total Dissipated Power	AC Drive Catalog No.
400 V 50 Hz	460 V 60 Hz				
kw	hp	A	A	W	
0.75	—	2.0	2.2	90.0	ATV66U41N4
—	1	1.8	2.0	90.0	
1.5	—	3.7	4.0	110	
—	2	3.4	3.7	110	
2.2	—	5.3	5.8	130	
—	3	4.8	5.3	130	
3.0	—	7.1	7.8	150	
4.0	—	9.5	10.5	180	ATV66U54N4
—	5	7.6	8.4		
5.5	—	11.8	13.0	205	ATV66U72N4
—	7.5	11.0	12.1		
7.5	—	16.0	17.6	265	ATV66U90N4
—	10	14.0	15.4		
11.0	—	22.0	24.2	350	ATV66D12N4
—	15	21.0	23.1		
15.0	—	30.0	33.0	480	ATV66D16N4
—	20	27.0	29.7		
18.5	—	37.0	40.7	560	ATV66D23N4
—	25	34.0	37.4		
30.0	—	60.0	66.0	800	ATV66D33N4
—	40	52.0	57.2	800	
37.0	—	72.0	79.2	910	ATV66D46N4
—	50	65.0	71.5		
45.0	—	85.0	93.5	960	ATV66D54N4
—	60	77.0	84.7		
55.0	—	105	115	1150	ATV66D64N4
—	75	96.0	105		
75.0	—	143	151	1400	ATV66D79N4
—	100	124	136		
90.0	—	170	187	2271	ATV66C10N4
—	125	156	171		
110	—	205	226	2596	ATV66C13N4
—	150	180	198		
132	—	245	270	3246	ATV66C15N4
—	200	240	264		
200	—	370	407	5246	ATV66C23N41
—	300	360	396		
220	—	408	449	5966	ATV66C28N41
—	350	420	462		
250	—	460	506	6624	ATV66C31N41
—	400	477	525		

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Table 3: Variable Torque, Low Noise AC Drive Ratings 460 V

400 V ±15% and 460 V ±15%, 50/60 Hz ±5%
Switching Frequency: ATV66U41N4 to D46N4 = 10 kHz, ATV66D54N4 to D79N4 = 4 kHz

Motor Power		Output Current	Max. Transient Current (60 s)	Total Dissipated Power	AC Drive Catalog No.
400 V 50 Hz	460 V 60 Hz				
kw	hp	A	A	W	
0.75	—	2.0	2.2	90.0	ATV66U41N4
—	1	1.8	2.0	90.0	
1.5	—	3.7	4.0	110	
—	2	3.4	3.8	110	
2.2	—	5.3	5.8	130	
—	3	4.8	5.3	130	
3.0	—	7.1	7.8	150	ATV66U54N4
4.0	—	9.5	10.5	180	ATV66U72N4
—	5	7.6	8.4		
5.5	—	11.8	13.0	205	ATV66U90N4
—	7.5	11.0	12.1		
7.5	—	16.0	17.6	265	ATV66D12N4
—	10	14.0	15.4		
11	—	22	24.2	350	ATV66D16N4
—	15	21	23.1		
15	—	30	33.0	480	ATV66D23N4
—	20	27	29.7		
22	—	44	48.4	600	ATV66D33N4
—	30	40	44.0		
30	—	60	66.0	800	ATV66D46N4
—	40	52	57.2		
37	—	72	79.2	910	ATV66D54N4
—	50	65	71.5		
45	—	85	93.5	960	ATV66D64N4
—	60	77	84.7		
55	—	105	115	1150	ATV66D79N4
—	75	96	105		

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208 V AND 230 V AC DRIVES

Tables 4, 5, and 6 show the power and current ratings for 230 V AC drives when set for constant torque (Table 4); variable torque (Table 5); and variable torque, low noise (Table 6).

Table 4: Constant Torque AC Drive Ratings, 208 V/230 V

208 V ±10% and 230 V ±15%, 50/60 Hz ±5%
Switching Frequency: ATV66U41M2 to D33M2 = 4 kHz, ATV66D46M2 = 2 kHz

Motor Power 208/230 V 50/60 Hz		Output Current	Max. Transient Current (60 s)	Total Dissipated Power	AC Drive Catalog No.
kw	hp	A	A	W	
.75 1.5 2.2	1 2 3	4.0 7.5 10.6	6.0 11.3 15.9	120 140 170	ATV66U41M2
4	5	16.7	25.1	239	ATV66U72M2
5.5	7.5	24.2	36.3	354	ATV66U90M2
7.5	10	30.8	46.2	437	ATV66D12M2
11	15	46.2	69.3	589	ATV66D16M2
15	20	59.4	89.1	728	ATV66D23M2
22	30	88.0	132	1052	ATV66D33M2
30	40	114	171	1439	ATV66D46M2

Table 5: Variable Torque AC Drive Ratings 208 V/230 V

208 V ±10% and 230 V ±15%, 50/60 Hz ±5%
Switching Frequency: ATV66U41M2 to D33M2 = 4 kHz, ATV66D46M2 = 2 kHz

Motor Power 208/230 V 50/60 Hz		Output Current	Max. Transient Current (60 s)	Total Dissipated Power	AC Drive Catalog No.
kw	hp	A	A	W	
.75 1.5 2.2	1 2 3	4.0 7.5 10.6	11.7 8.3 11.7	120 140 170	ATV66U41M2
5.5	7.5	24.2	26.6	302	ATV66U72M2
7.5	10	30.8	33.9	414	ATV66U90M2
11.0	15	46.2	50.8	559	ATV66D12M2
15.0	20	59.4	65.32	770	ATV66D23M2
18.5	25	74.8	82.3	831	
30.0	40	114	125	1260	ATV66D33M2
37.0	50	143	157	1528	ATV66D46M2

Table 6: Variable Torque, Low Noise AC Drive Ratings 208 V/230 V

208 V ±10% and 230 V ±15%, 50/60 Hz ±5%
Switching Frequency: ATV66U41M2 to D33M2 = 10 kHz, ATV66D46M2 = 4 kHz

Motor Power 208/230 V 50/60 Hz		Output Current	Max. Transient Current (60 s)	Total Dissipated Power	AC Drive Catalog No.
kw	hp	A	A	W	
.75 1.5 2.2	1 2 3	4.0 7.5 10.6	4.4 8.3 11.7	125 150 181	ATV66U41M2
4.0	5	16.7	18.4	252	ATV66U72M2
5.5	7.5	24.2	26.6	375	ATV66U90M2
7.5	10	30.8	33.9	459	ATV66D12M2
11.0	15	46.2	50.8	619	ATV66D16M2
15.0	20	59.4	65.3	785	ATV66D23M2
22.0	30	88.0	96.8	1127	ATV66D33M2
30.0	40	114	125	1332	ATV66D46M2

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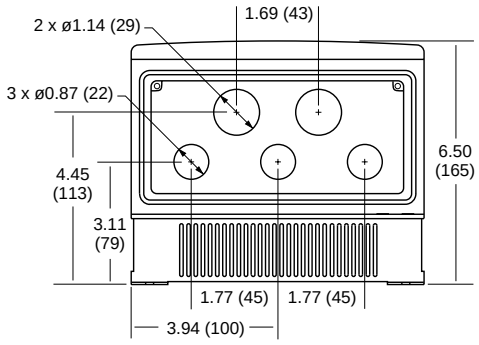
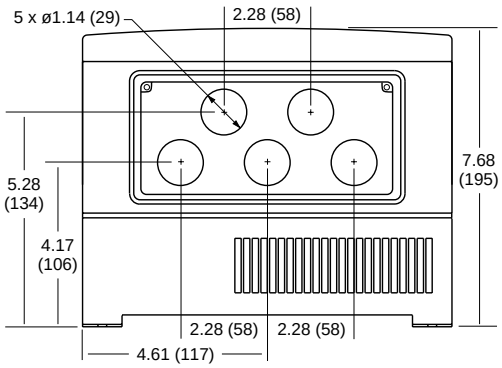
Dimensions & Weights for Wall or Panel Mounting

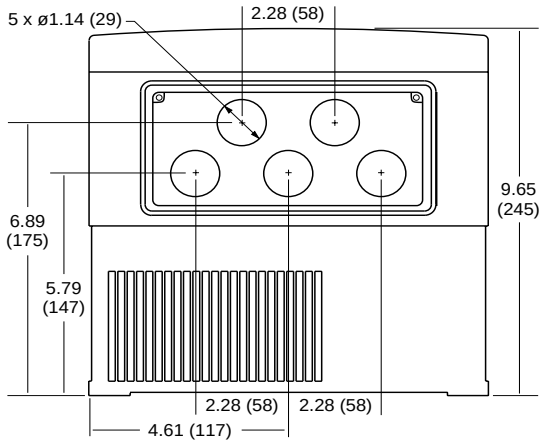
Conduit Entries - Bottom View



Outline 1

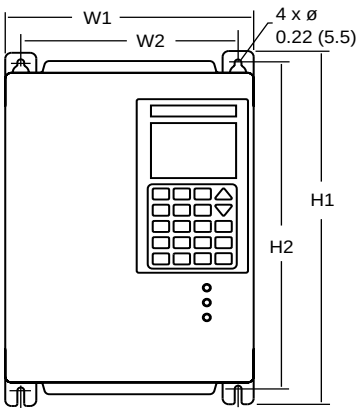


Outline 2



Outline 3

Mounting



Dimensions: in (mm)

Mounting Dimensions

Outline	AC Drive ATV66•••N4	AC Drive ATV66•••M2	H1		H2		W1		W2		Ø		Weight		Door Swing Clearance[1]	
			in	mm	in	mm	in	mm	in	mm	in	mm	lb	kg	in	mm
1	U41–U72	U41	11.6	295	10.9	280	7.8	200	6.9	175	0.22	5.5	10.4	4.7	7.8	200
2	U90, D12	U72, U90	12.8	325	12.2	310	9.2	234	8.2	209	0.22	5.5	16.1	7.3	9.2	234
3	D16, D23	D12, D16	16.3	415	15.7	400	9.2	234	8.2	209	0.22	5.5	30.9	14	9.2	234

[1]Door hinges on left-hand side of AC drive.

NOTE: When metallic conduit is used with AC drives of Outlines 1–3, install a metal conduit entry plate (kit VY1A66201 — separately ordered). Kit mounts in place of the existing plastic plate and has a conduit hole pattern identical to those shown for Outlines 1–3.

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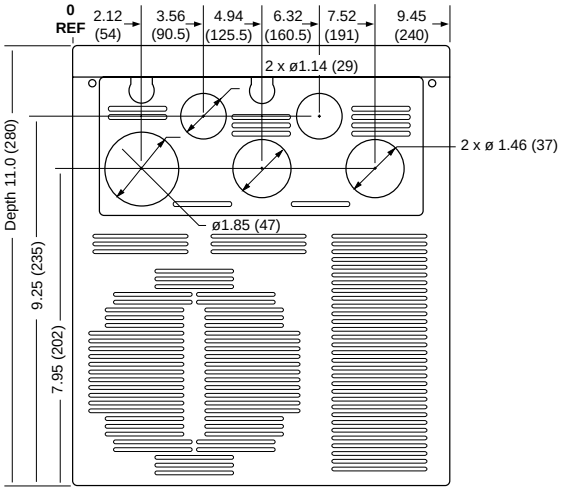
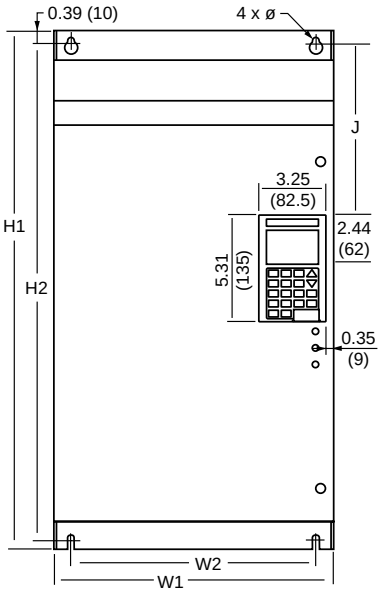
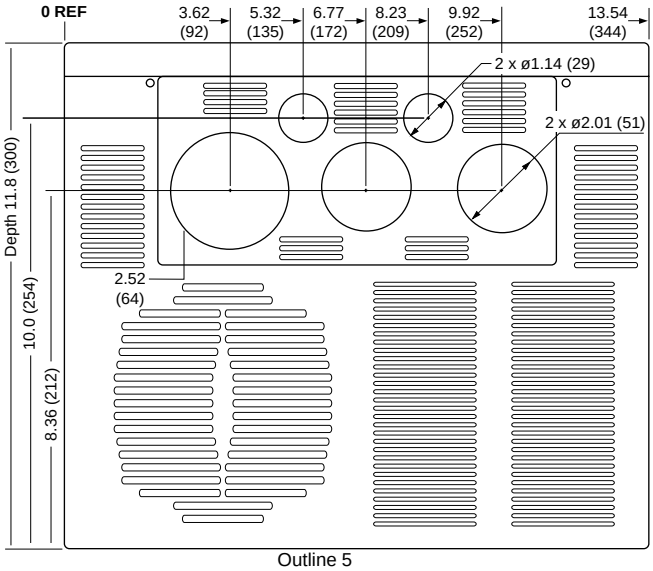
Conduit Entries - Bottom View



Outline 4

Mounting





Outline 5

Dimensions: in (mm)

Mounting Dimensions

Outline	AC Drive ATV66•••N4	AC Drive ATV66•••M2	H1		H2		W1		W2		Ø		J		Weight		Door Swing Clearance [1]	
			in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	lb	kg	in	mm
4	D33, D46	D23, D33	23.6	600	22.8	580	9.5	240	8.1	205	0.28	7	3.19	81	59.5	27	9.5	240
5	D54–D79	D46	25.6	650	24.4	620	13.8	350	11.8	300	0.35	9	3.39	86	88.2 90.4	40 41	13.8	350

[1]Door hinges on left-hand side of AC drive.

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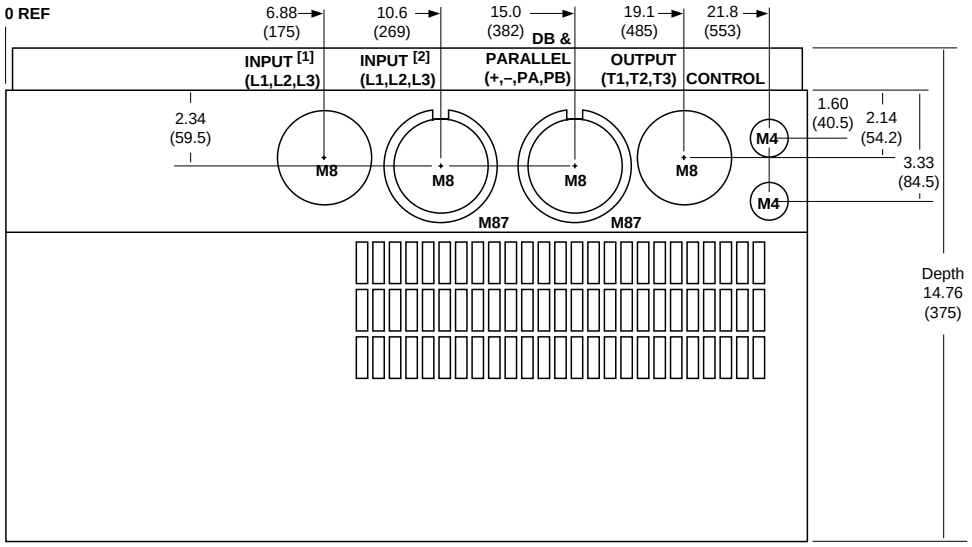
Conduit Entries - Bottom View



Outline 6

KNOCKOUTS:

M4 = 2 x 1.00 (25.4) dia.

M7 = 2.00 (50.8) dia.

M8 = 2.50 (63.5) dia.

M87 = 3.00 (76.2) dia. w/ 2.50 (63.5) dia.

NOTES:

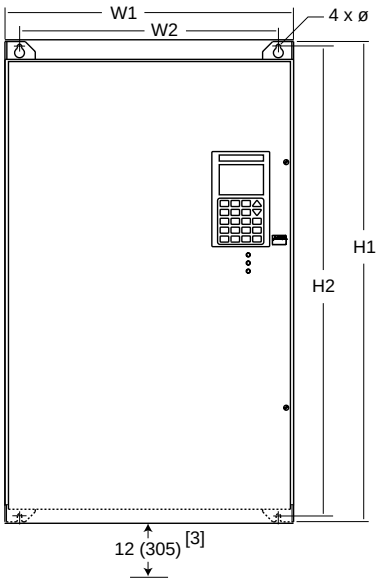
[1] Use 2 in (50.8 mm) knockout for parallel cable runs.

[2] Use single 3 in (76.2 mm) knockout for single cable run.

[3] Leave an area extending 13.5 in. (343 mm) below drive free of obstructions to allow access to ventilation fan.

Dimensions: in (mm)

Mounting



Mounting Dimensions

Outline	AC Drive ATV66•••N4	H1		H2		W1		W2		Ø		Weight		Door Swing Clearance [1]	
		in	mm	in	mm	in	mm	in	mm	in	mm	lb	kg	in	mm
6	C10 C13, C15, C19	38.6	980	37.7	960	23.0	585	20.8	528	.375	9.5	280 300	127 136	23	584

[1]Door hinges on left-hand side of AC drive.

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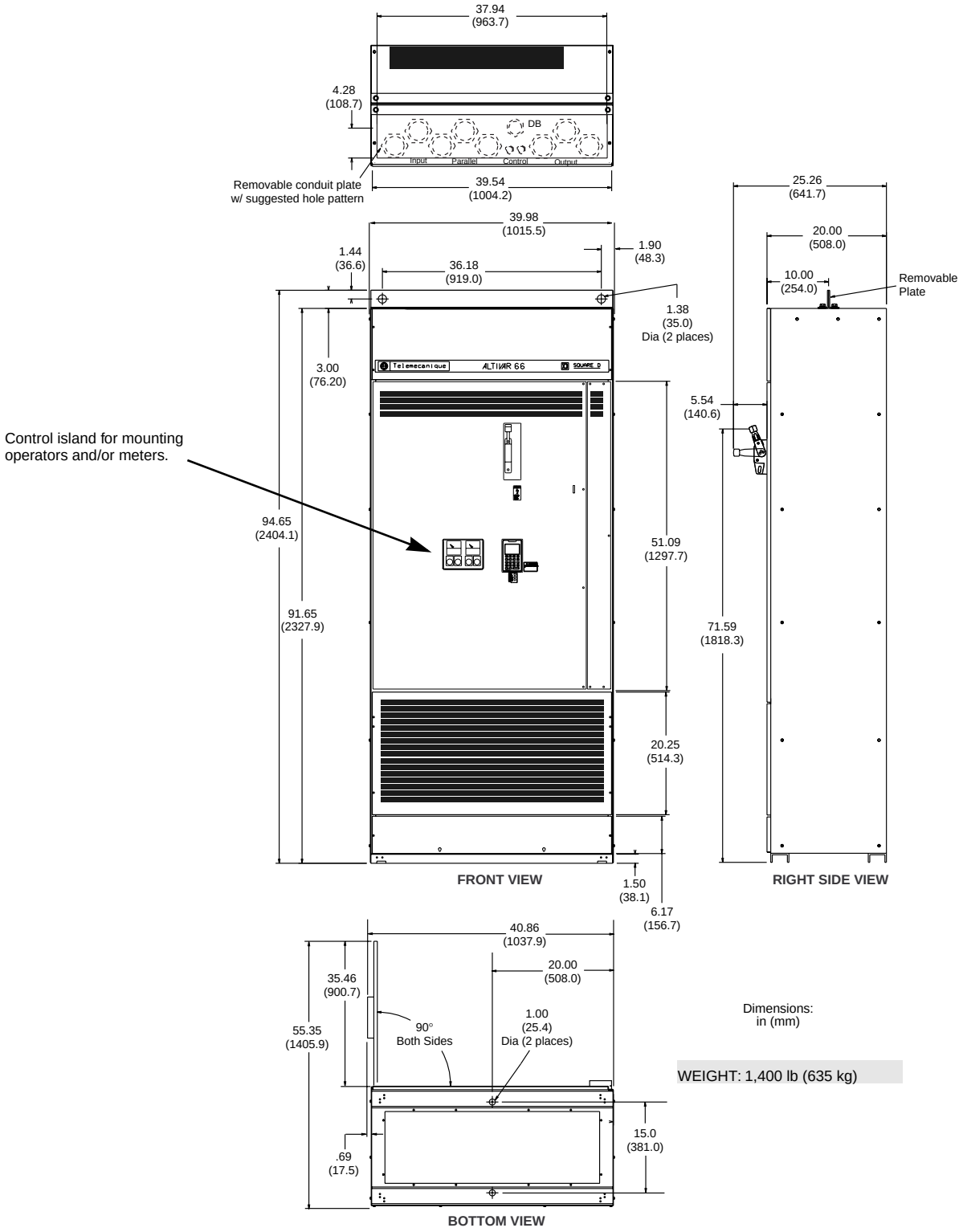

Outline 7

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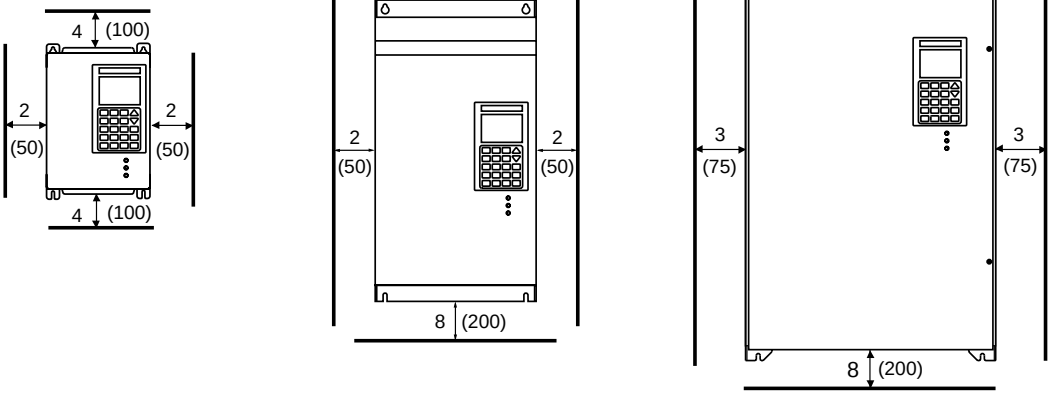
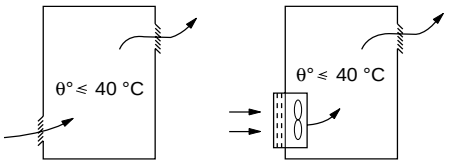
Mounting Precautions



When mounting the drive:

- To prevent thermal fault or equipment damage, provide sufficient enclosure cooling and/or ventilation to limit the ambient temperature around the drive to a maximum of 40 °C. Air should circulate from bottom to top.
- Install drive vertically.
- Avoid placing drive near heat producing elements.
- When installation surface is uneven, put a spacer behind the drive mounting pads to eliminate gaps.
- The ALTIVAR 66 drive is Type 1. The environment around the drive must not exceed Pollution Degree 3 requirements as defined in NEMA ICS 1-111A or IEC 664.

Mounting in General Purpose Enclosure



Follow the mounting precautions above. To ensure sufficient air circulation in the drive:

- Provide air vents.
- Observe minimum clearances shown above.
- If necessary, install a fan with filter in the enclosure with a flow rate greater than that listed below.

Drives	Fan Characteristics
ATV66U41N4 and U54N4	10 CFM (5 dm^3/s)
ATV66U72N4	20 CFM (10 dm^3/s)
ATV66U90N4-D12N4	44 CFM (22 dm^3/s)
ATV66D16N4-D23N4	94 CFM (47 dm^3/s)
ATV66D33N4-D79N4	200 CFM (100 dm^3/s)
ATV66C10N4-C19N4	500 CFM (250 dm^3/s)
ATV66C23N41-C31N41	1000 CFM (500 dm^3/s)

Mounting in Type 12 (IP54) Enclosure

Certain environmental conditions such as dust, corrosive gas and high humidity with risk of condensation require that the drive be mounted in a Type 12 (IP54) enclosure. Follow the mounting precautions given above and observe minimum clearances shown. In addition, to avoid hot spots in the drive, provide an auxiliary fan kit to stir the air.

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Calculation of Enclosure Dimensions

Maximum thermal resistance Rth (°C/W):

$$Rth = \frac{T_i - T_o}{P}$$

T_i = Max. internal ambient temp. (°C) around drive = 40 °C

T_o = Max. external ambient temp. (°C) around enclosure

P = Total power dissipated in enclosure (W)

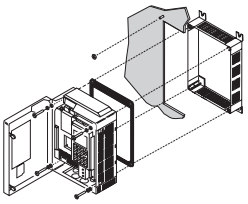
For power dissipated by the drive, see tables on pages 53-56. Add power dissipated by other components in enclosure. Useful heat exchange surface area S (in^2): Sides + top + front (if enclosure is wall-mounted):

$$S = \frac{K}{Rth}$$

Rth = Thermal resistance of enclosure (calculated above)

K = Area resistivity of enclosure material

- Use only metallic enclosures.
- Do not install enclosures where external heat sources can add to enclosure heat load.
- The mounting method must allow for free air movement over all surfaces considered for useful heat exchange surface area.



Recess Mounting Kit (Degree of Protection Type 12, IP54)

To reduce power dissipated in the enclosure, ATV66U41N4 to D23N4 drives may be recess mounted in a wall of the enclosure with the heat sink on the outside. This requires a cutout in the enclosure and a recess mounting kit which consists of gaskets, instructions, and cut-out dimensions.

Gasket Kit

Drives	Catalog Numbers
ATV66U41N4 to U72N4 and U91M2	VW3A66801T
ATV66U90N4, D12N4, U72M2 and U90M2	VW3A66802T
ATV66D16N4, D23N4, D12M2 and D16M2	VW3A66803T

A kit similar to the gasket kit, but also including a mounting adapter plate, is available.

Mounting Adapter Plate Kit

Drives	Catalog Numbers
ATV66U41N4 to U72N4 and U91M2	VW3A66806
ATV66U90N4, D12N4, U72M2 and U90M2	VW3A66807
ATV66D16N4, D23N4, D12M2 and D16M2	VW3A66808

For this type of mounting, the heat sink and fan on the outside of the enclosure is Type 12/IP54 degree of protection. Power dissipated by the drive in an enclosure when recess mounted:

Drives	Power in W
ATV66U41N4 to U72N4	70
ATV66U90N4 to D12N4	75
ATV66D16N4	110
ATV66D23N4	130

Risk of Condensation

If there is a possibility of condensation, keep the control supply switched on during periods when the motor is not running, or install thermostatically-controlled strip heaters.

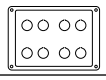
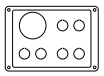
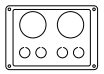
Keypad Door Mounting Kit

The keypad display can be mounted on the door of the enclosure. The kit consists of a plastic key holder, gasketing, and either a 2- or 3-meter cable. Green, red, and yellow LEDs are also included for mounting below the remote-mounted keypad.

Catalog Number	Description
VW3A66100	Keypad door mounting kit with 2-meter cable
VW3A66101	Keypad door mounting kit with 3-meter cable.

Control Island Kit

Three control islands are available for ALTIVAR 66 drive controllers:

Control Island (Front Views)	Number of Meters	Number of Operators
	0	8
	1	6
	2	4

The VW3A66102-VW3A66104 Control Island Kits are designed for use with the following operators and meters: Telemecanique Type ZA2B Operators, WINDO™ Series DW 2-1/2" surface mount digital panel meters, and MODUTEC® S Series 2-1/2" surface mount analog meters. When used with compatible operators and meters and the recommended panel gaskets, the control island maintains Type 12/IP54 integrity of the enclosure sidewall. The control island meets or exceeds impact and flame resistance requirements of UL 50

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Power Terminal Descriptions

Terminal	Function	Characteristics
GND L2 L1 L3	3-phase power supply	400/460 VAC ±15% (ATV66•••N4 units) 208 V ±10% / 230 V ±15% (ATV66•••M2 units) 47–63 Hz
+ –	Filtered DC voltage	550–850 VDC (ATV66•••N4 units) 275–425 VDC (ATV66•••M2 units)
U/T1 W/T3 V/T2 GND	Output connections to motor	0–400 VAC / 0–460 VAC 0–208 VAC / 0–230 VAC
CL1 CL2	Single-phase control supply	400/460 VAC ±15% (ATV66•••N4 units) 208 V ± 10% / 230 V ± 15% (ATV66•••M2 units) 47–63 Hz
PA PB	Dynamic braking resistor	550–850 VDC (ATV66•••N4 units) 275–425 VDC (ATV66•••M2 units)
CL21 CL22	Tap for CL1 & CL2	400/460 VAC ±15% (ATV66•••N4 units) 208 V ± 10% / 230 V ± 15% (ATV66•••M2 units) 47–63 Hz ATV66D16N4 to C31N41 AC drives only

The CL1 & CL2 terminals are connected with jumpers to L1 & L2 terminals. When using a line contactor, the jumpers must be removed and CL1 & CL2 supplied separately to maintain control power. See circuit diagrams on page 66. CL1 & CL2 must be connected to the same feeder conductors that supply L1, L2 & L3 of the AC drive.

Power Terminal Wire Range

NOTE: All wire entries in AWG or Thousand Circular Mills (MCM) represent the maximum allowable conductor size for the referenced field wiring terminal. All wire entries in square mm (mm^2) represent the recommended size of conductor based on IEC 364 conductor dimensioning criteria. Do not use the IEC 364 conductor selections for installations requiring dimensioning per NFPA 70 or CSA C22.

Terminals			Drive Controller (ATV66•••••)							
			U41N4 U54N4 U72N4 U41M2 [1]	U90N4 D12N4 U72M2U 90M2 [1]	D16N4 D23N4 D12M2 D16M2 [1]	D33N4 D46N4 D23M2 D33M2 [2]	D54N4 D64N4 D79N4 D46M2 [2]	C10N4 C13N4 [2]	C15N4 C19N4 [2]	C23N41 C28N41 C31N41 [2]
CL1, CL21 CL2 CL22	Max. Wire Size	AWG mm^2	10 2.5	6 10	12 2.5	12 2.5	12 2.5	8 8	8 8	8 8
	Terminal Torque	lb-in N•m	6.73 0.76	35.4 4	6.73 0.76	6.73 0.76	6.73 0.76	20 2.3	20 2.3	20 2.3
L1 L2 L3	Max. Wire Size	AWG mm^2	10 2.5	6 10	4 10	2/0 35	4/0 70	350 MCM 120	2 x 300 MCM 185	3 x 500 MCM
	Terminal Torque	lb-in N•m	6.73 0.76	35.4 4	17.7 2	88 10	170[4] 19	325 36.7	375 42.4	375
U/T1 V/T2 W/T3	Max. Wire Size	AWG mm^2	10 2.5	6 10	4 10	2/0 35	4/0 70	350 MCM 120	350 MCM 185	3 x 500 MCM
	Terminal Torque	lb-in N•m	6.73 0.76	35.4 4	17.7 2	88 10	170[4] 19	325 36.7	325 36.7	375
+ –	Max. Wire Size	AWG mm^2	10 2.5	6 10	4 10	2/0 35	4/0 70	350 MCM 120	350 MCM 185	3 x 500 MCM
	Terminal Torque	lb-in N•m	6.73 0.76	35.4 4	17.7 2	88 10	170[4] 19	325 36.7	325 36.7	375
PA PB	Max. Wire Size	AWG mm^2	10 2.5	6 10	8 6	4 16	2 35	2/0 35	2/0 35	3 x 500 MCM
	Terminal Torque	lb-in N•m	6.73 0.76	35.4 4	10.6 1.2	17.7 2	26.5 3	120[3] 13.6	120[3] 13.6	375
GND IN	Max. Wire Size	AWG mm^2	6 6	6 10	4 10	4 16	2 35	350 MCM 70	350 MCM 95	3 x 350 MCM
	Terminal Torque	lb-in N•m	17.7 2	35.4 4	17.7 2	26.5 3	26.5 3	325 36.7	325 36.7	325
GND OUT	Max. Wire Size	AWG mm^2	6 6	6 10	4 10	4 16	2 35	350 MCM 70	350 MCM 95	3 x 350 MCM
	Terminal Torque	lb-in N•m	17.7 2	35.4 4	17.7 2	26.5 3	26.5 3	325 36.7	325 36.7	325

[1] 60/75 °C copper.
[2] 75 °C copper.
[3] For 10 - 14 AWG (2.5 - 5 mm^2) conductors, use 35.4 lb-in (4 N•m) torque; and for 8 AWG (8 mm^2) conductors, use 40 lb-in (4.5 N•m) torque.
[4] For 2/0 AWG (35 mm^2) and smaller conductors, use 88 lb-in (10 N•m) torque.

The LI, L2, and L3 terminals on the ATV66C15N4 and C19N4 drive controllers are equipped with metric hex head bolts requiring a 13 mm socket. The other terminals (except PA & PB) require a 3/8 inch hex wrench, supplied with the drive controller. Terminals PA and PB require a 3/16 inch hex wrench, supplied with the drive controller.

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Control Terminal Descriptions

Connector	Terminal [1]	Function		Characteristics
J1 [2]	R1A [3] R1B R1C	N.O. contact [4] N.C. contact Common	Fault relay output	Minimum: 10 mA, 24 VDC Maximum: inductive load of: 2.0 A, 120 VAC; max: 0.10 J/operation, 80 operations/minute 1.0 A, 220 VAC; max: 0.25 J/operation, 25 operations/minute 2.0 A, 24 VDC; max: 0.10 J/operation, 80 operations/minute Arc suppression provided by varistors in parallel with relay contacts
	R2A R2B R2C	N.O. contact [4] N.C. contact Common	Program-mable relay output	
J12 [2]	LI1 LI2 LI3 LI4 +24 LOP LO1 LO2 COM	Logic input 1 Logic input 2 Logic input 3 Logic input 4 Control supply LO supply input Logic output 1 Logic output 2 Logic common		24 V, 10 mA; State 0: V < 5 V; State 1: V>12 V; Vmax = 30 V 24 V, 10 mA; State 0: V < 5 V; State 1: V>12 V; Vmax = 30 V 24 V, 10 mA; State 0: V< 5 V; State 1: V>12 V; Vmax = 30 V 24 V, 10 mA; State 0: V < 5 V; State 1: V>12 V; Vmax = 30 V Is = 210 mA max. [5] Minimum: 12 V, Maximum: 30 V, quiescent current: typical 15 mA 24 V, 200 mA max. [5] 24 V, 200 mA max. [5] 0 V
J13 [2]	S COM AI1 +10 AI2	Shield/Ground Space, for isolation Speed reference common Input 1: Speed ref. voltage Reference supply Input 2: Speed ref. current		 0 V 0–10 V, Z = 30 kΩ 10 V, Is = 10 mA max. 4–20 mA [6], Z = 250 Ω
	AO1 AO2 COM	Analog output 1 Analog output 2 Analog common		0–20 mA, 12 V max. (programmable as 4–20 mA w/ keypad display) 0–20 mA, 12 V max. (programmable as 4–20 mA w/ keypad display) 0 V

[1] See circuit diagrams on pages 65 and 66.

[2] Max. wire size for all terminals: 14 AWG (2.5 mm^2). Tightening torque: 3.5 lb-in (0.4 n•m).

[3] Relay coil deenergizes on fault.

[4] Contact state with AC drive deenergized.

[5] Total current of + 24 V internal supply is 210 mA. Available current of the two logic outputs can be calculated as follows: each logic input requires 10 mA, each analog output requires 20 mA and the typical quiescent current of LOP is 15 mA. For example, in an application where three logic inputs and one analog output are used, the total available current is 210 mA - (3 x 10 mA) - (1 x 20 mA) - 15 mA = 145 mA to drive the logic output loads. If more current is required, an external supply must be used.

[6] 0–20 mA, x–20 mA, 20–4 mA programmable with keypad display. 0–5 V (Z = 30 kΩ) selectable with switch on control board.

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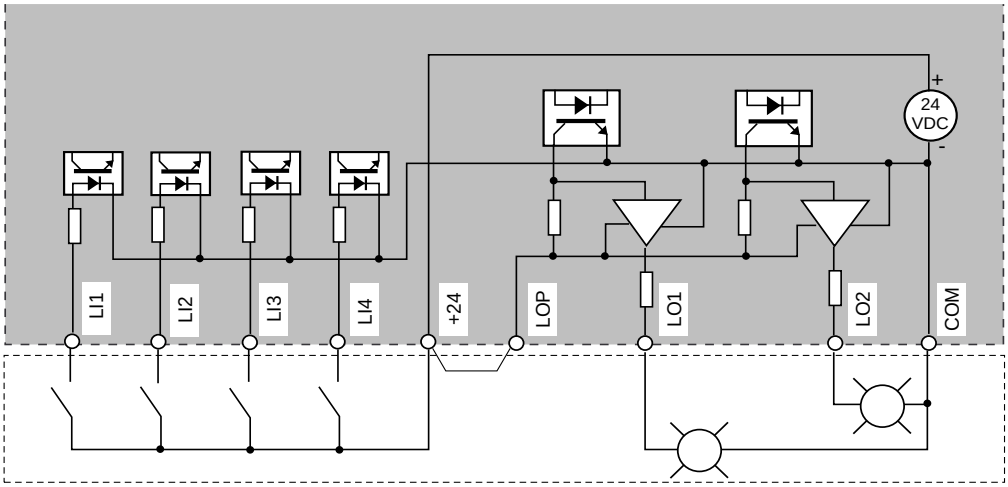
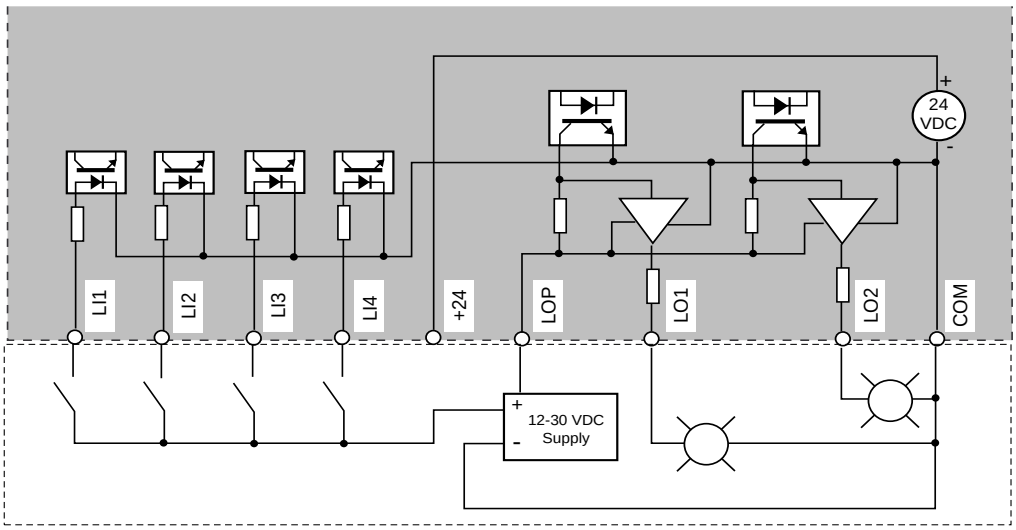
Input/Output Wiring

Logic inputs/outputs with internal supply (210 mA maximum)



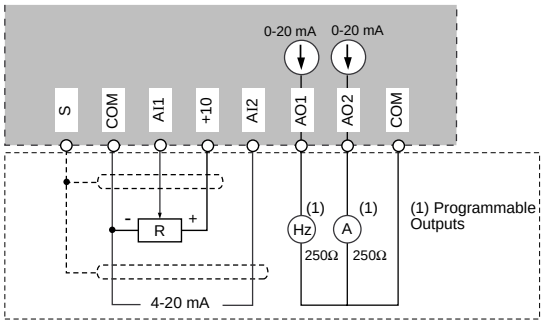
Customer Supplied

Logic inputs/outputs with external supply



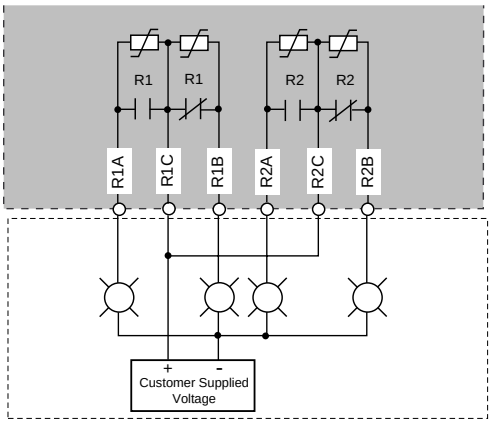
Customer Supplied

Analog inputs and outputs



Customer Supplied

Relays



Customer Supplied

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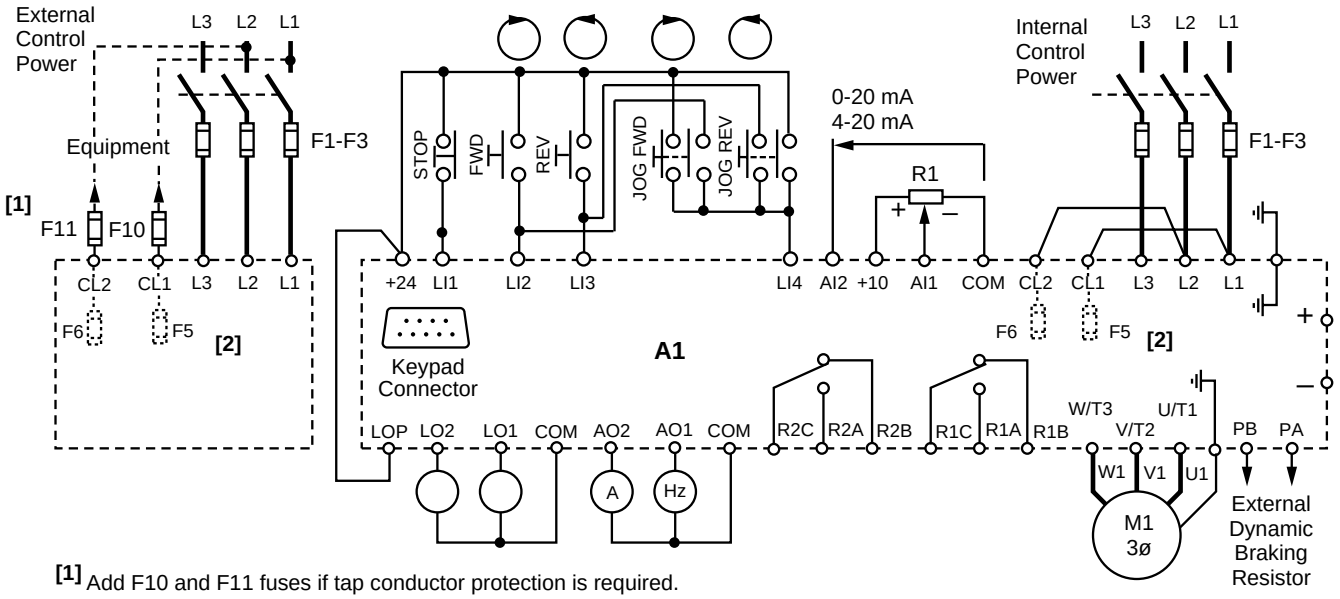
ALTIVAR 66 AC Drives
Wiring Diagrams

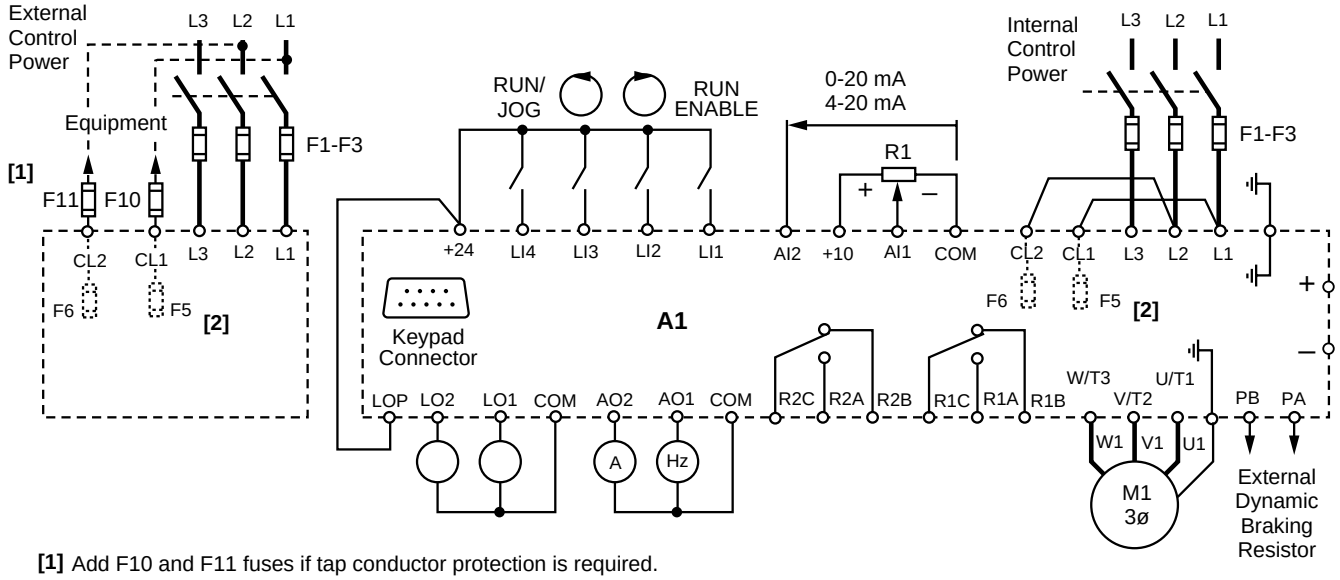
3-Wire Control



[1] Add F10 and F11 fuses if tap conductor protection is required.
The CL1 and CL2 inputs of all ATV66 drive controllers are internally protected and require no external fusing.

[2] F5 and F6 fuses are present only on ATV66C10 to ATV66C31 drive controllers.

2-Wire Control



[1] Add F10 and F11 fuses if tap conductor protection is required.
The internally protected CL1 and CL2 inputs of all ATV66 drive controllers require no external fusing.

[2] F5 and F6 fuses are present only on ATV66C10 to ATV66C31 drive controllers.

The I/O Extension Module has three terminal strips for connections to external devices:

- J24: 4-pin terminal strip, 2 relay contacts
- J23: 10-pin terminal strip for analog I/O
- J22: 5-pin (VW3A66201T, 24 VDC) or 9-pin (VW3A66202T, 115 VAC) terminal strip for logic I/O

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The following table lists the characteristics of the I/O Extension Module inputs and outputs.

Connector		Terminal	Function	Characteristics
J24		R3A R3C R4A R4C	Relay output 3, N.O. contact Relay 3 common Relay output 4, N.O. contact Relay 4 common	Minimum: 10 mA, 24 VDC Maximum: inductive load of: 2 A, 120 VAC; max: 0.10 J/operation, 80 operations/minute 1 A, 220 VAC; max: 0.25 J/operation; 25 operations/minute 2 A, 24 VDC; max: 0.10 J/operation, 80 operations/minute Arc suppression provided by varistors in parallel with relay contacts.
J23		S COM AI3A AI3B +10 -10 AI4 AO3 COM	Analog shield Space, for isolation Analog common Differential analog input 3A (+) Differential analog input 3B (-) Reference input supply Reference input supply Analog input 4 Analog output 3 Digital common	 0 V ±10 V 0 V reference for AI3A +10 VDC, Is = 10 mA maximum -10 VDC, Is = 10 mA maximum 4-20 mA, z = 250 Ω 0 - 20 mA, z = 250 Ω 0 V
J22	24 VDC VW3- A66201T	LI5 LI6 LI7 LI8 +24	Logic input 5 Logic input 6 Logic input 7 Logic input 8 Logic inputs supply	LI5-LI8: 24 VDC, 10 mA, Vmax. = 30 V, state 0: V < 5 V, state 1: V > 12V 24 VDC, Is = 80 mA max.
	115 VAC VW3- A66202T	LI1 LI2 LI3 LI4 LI5 LI6 LI7 LI8 L2	Logic input 1 Logic input 2 Logic input 3 Logic input 4 Logic input 5 Logic input 6 Logic input 7 Logic input 8 Customer supply input	 LI1-LI8: 115 VAC, Vmax = 140 V, Z = 30 kΩ, state 0: V < 30 V, state 1: V > 80 V

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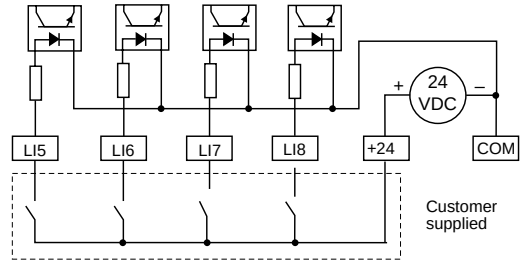
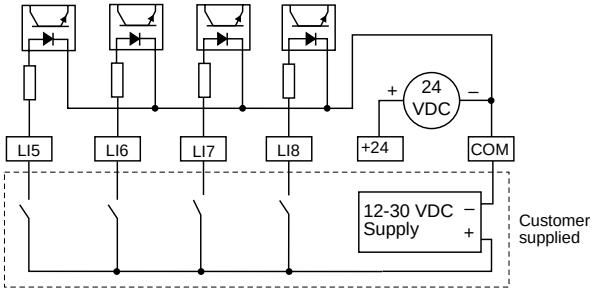
ALTIVAR 66 AC Drives
I/O Extension Module Wiring Diagrams

24 VDC VW3A66201

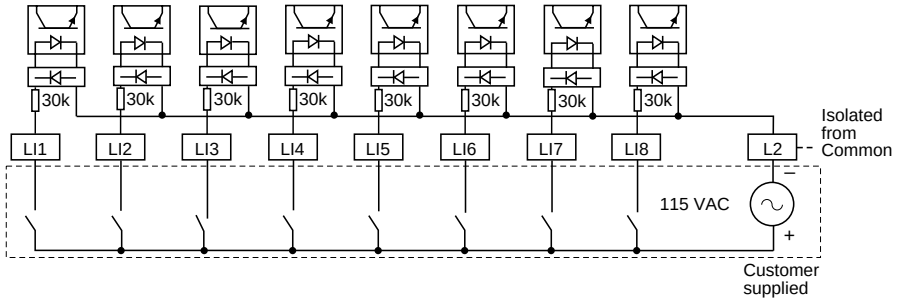


Logic inputs with internal supply

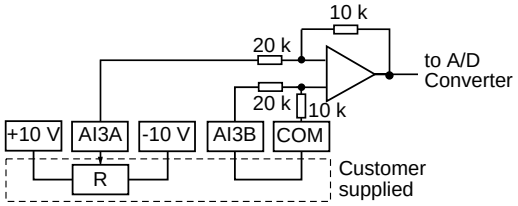


Logic inputs with external supply

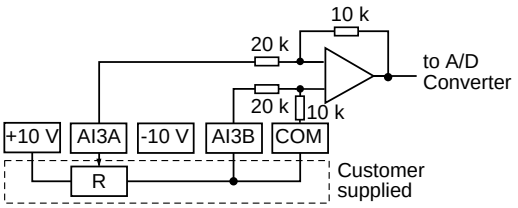
115 VAC VW3A66202



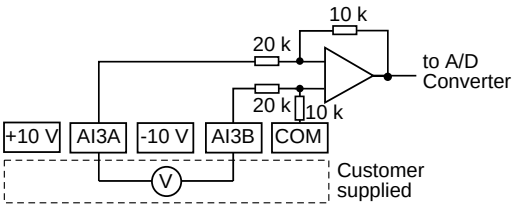
+/- 10 V input referenced to COM



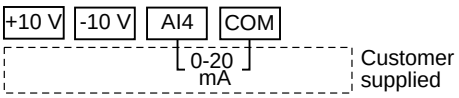
0 to 10 V input referenced to COM



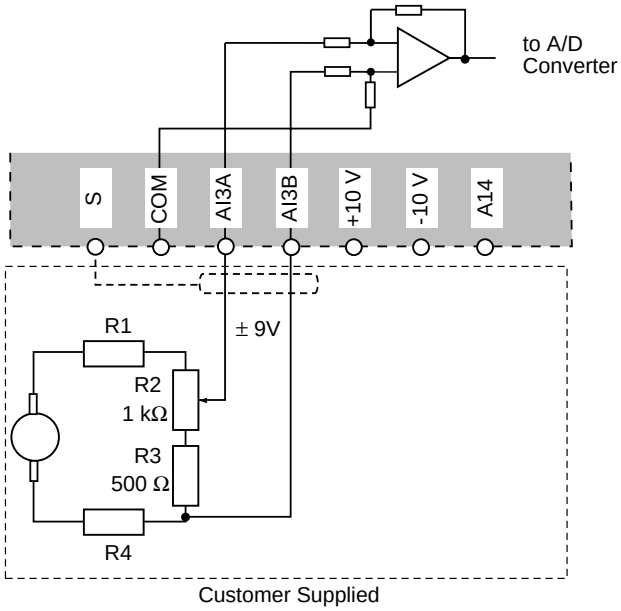
+/- 10 V input not referenced to COM



AI4 input



Tachogenerator connections



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DYNAMIC BRAKING OPTION

The dynamic braking option allows the ALTIVAR 66 drive to function in quadrants 2 and 4 of the speed/torque curve, dissipating the excess braking energy in an external resistor. The option consists of a resistor and circuit protection. Applications include machines with high inertia and machines with fast cycles. Automatic deceleration ramp modification is disabled when dynamic braking is installed.

Braking Resistor Kit Catalog Numbers

For Drives	Ohmic Value	Continuous Current Rating of Assembly a	Catalog Number	Qty of Kits Used
	Rdb	Ir		
ATV66U41N4, U54N4, U72N4	120 Ω	1.0 A	VW3A66711	1
ATV66U90N4, D12N4	56 Ω	1.45 A	VW3A66712	1
ATV66D16N4, D23N4	28 Ω	2.7 A	VW3A66713	1
ATV66D33N4, D46N4	14 Ω	3.8 A	VW3A66714	1
ATV66D54N4	10 Ω	10.0 A	VW3A66715	1
ATV66D64N4, D79N4	5 Ω	14.0 A	VW3A66716	1
ATV66C10N4, C13N4, C15N4, C19N4	2.5 Ω	20.0 A	VW3A66717	1
ATV66C23N41	2 Ω	32.0 A	VW3A66718	2
ATV66C28N41, C31N41	1.25Ω	40.0	VW3A66717	2

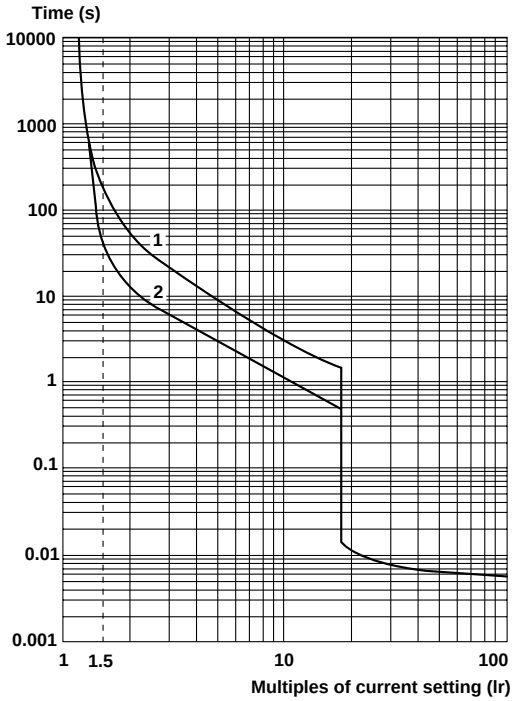
a Current rating of resistor assembly is calculated based on setting of internal overload protective device in assembly, overload setting based on enclosure overtemperature protection, and resistor overload versus time characteristics. Resistors are rated for stopping six times rotor inertia of 4-pole motor with drive at current limit.

Recommended Braking Resistance Values

460 V AC Drive Part No.	PA/PB Minimum Resistance Ω	208/230 V AC Drive Part No.	PA/PB Minimum Resistance Ω
ATV66U41N4	120	ATV66U41M2	47
ATV66U54N4	120	ATV66U72M2	18
ATV66U72N4	120	ATV66U90M2	18
ATV66U90N4	56	ATV66D12M2	12
ATV66D12N4	56	ATV66D16M2	9
ATV66D16N4	28	ATV66D23M2	6
ATV66D23N4	28	ATV66D33M2	4.5
ATV66D33N4	14	ATV66D46M2	3
ATV66D46N4	14		
ATV66D54N4	10		
ATV66D64N4	5.0		
ATV66D79N4	5.0		
ATV66C10N4	2.5		
ATV66C13N4	2.5		
ATV66C15N4	2.5		
ATV66C19N4	2.5		
ATV66C23N41	2.0		
ATV66C28N41	1.25		
ATV66C31N41	1.25		

Current-Time Characteristic for Dynamic Braking Resistor Assemblies

The curve below shows allowable time at 40 °C according to multiple current settings.



(1) Cold state
(2) Hot state

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CALCULATING RESISTOR SIZE

The dynamic braking kits listed on page 69 are suitable for a wide variety of stopping applications. However, precise calculation of the resistor is essential for severe applications requiring high braking power such as machines with high inertia and overhauling loads. To determine whether the dynamic braking kit is suitable, three parameters must be calculated:

- The peak braking power required during speed changes or stopping, P_i. The value of P_i determines the maximum allowable value of resistance.
- The amount of power which must be absorbed for a given time by the resistors during stopping or speed changes, P_s. These values of power and time determine the required time-current characteristic of the DB resistor.
- The average power which must be dissipated by the DB resistor during a cycle, P_a. The value of P_a determines the continuous current rating of the DB resistor.

The following section is an example of sizing the resistor.

CALCULATING RESISTOR SIZE: AN EXAMPLE

The motor has the following characteristics:

- Power: 5 hp
- Rated speed: 1740 RPM
- Moment of inertia: 0.28 lb-ft^2

The motor is driving a machine with inertia 10 times that of the motor with no interposing speed changer and resistive torque one tenth of the rated motor torque. The requirement is to stop in 5 seconds from rated speed at a rate of 2 cycles per minute.

Rated motor torque: $T_n = \frac{hp \times 5250}{rpm_{rated}} = \frac{5 \times 5250}{1740} = 15.1$ lb-ft

Cycle time: $t_c = \frac{60 \text{ seconds}}{2 \text{ operations per minute}} = 30$ s

Machine speed change during deceleration: $\Delta rpm = 1740 - 0 = 1740$ rpm

Machine deceleration time: $t_d = 5$ seconds

Resistive (friction) torque: $T_r = \frac{15.1}{10} = 1.51$ lb-ft

Overhauling torque: $T_o = 0$ lb-ft

Total inertia: $J_c = 0.28 + (10 \times 0.28) = 3.08$ lb-ft^2

Braking torque: $T = \frac{J_c \times \Delta rpm}{308 \times t_d} = \frac{3.08 \times 1740}{308 \times 5} = 3.48$ lb-ft

Required motor braking torque: $T_b = T_j + T_o - T_r = 3.48 + 0 - 1.51 = 1.97$ lb-ft

The required motor braking torque must not exceed the motor's ability to produce torque. For inertial loads such as in this example, the required braking torque must be less than 1.5 times the motor rated torque for constant torque applications, or 1.1 times the motor rated torque for variable torque applications.

For continuously overhauling loads, the value of the overhauling torque (T_o) - the resistive torque (T_r) must be less than the motor continuous torque rating at any speed.

From this we see:

The peak braking power required during speed changes or stopping:

$$P_i = \frac{T_b \times rpm}{7.04} = \frac{1.97 \times 1740}{7.04} = 487 \text{ W}$$

The amount of power which must be absorbed for a given time by the resistors during stopping or speed changes:

$$P_d = 0.5 \times P_i = 243 \text{ W}$$

The average power which must be dissipated by the DB resistor during a cycle:

$$P_a = P_d \times \frac{t_d}{t_c} = 243 \times \frac{5}{30} = 40.5 \text{ W}$$

Therefore, the resistor selected must meet these characteristics. For the VW3A66711 DB resistor selected for the 5 hp drive:

The peak braking power is:

$$P_i = \frac{(1.35 \times V)^2}{R_{db}} = \frac{(1.35 \times 460)^2}{120} = 3212 \text{ W}$$

The braking power which can be absorbed for 5 seconds (t_d) based on the DB resistor hot state current-time characteristic curve on page 69:

The average braking power:

$$P_a = R_{db} \times (I_r)^2 = 120 \times 1^2 = 120 \text{ W}$$

For this example the VW3A66711 DB resistor kit will work.

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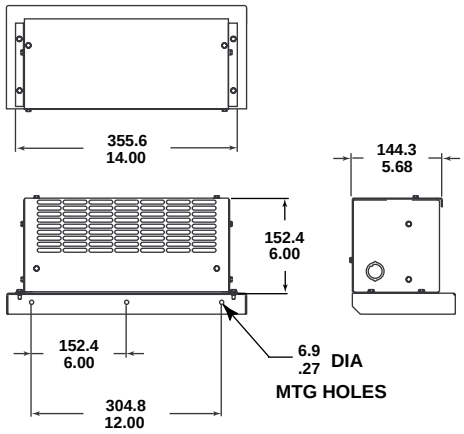
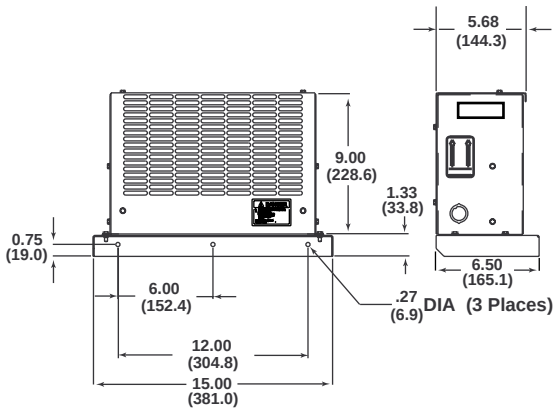
DYNAMIC BRAKING ENCLOSURE DIMENSIONS

Dimensions: mm / in

VW3A66711 and VW3A66712

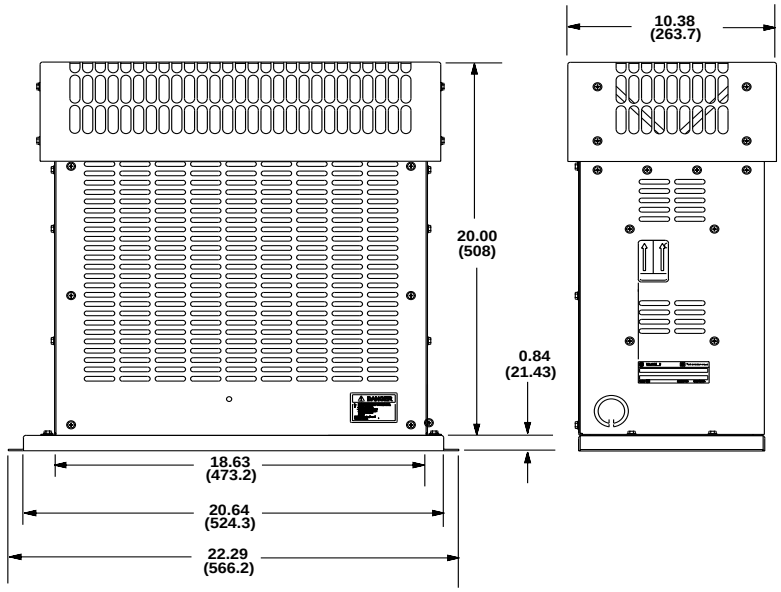


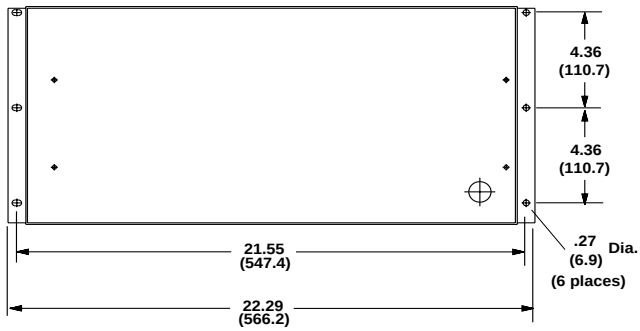
VW3A66713 and VW3A66714



VW3A66715, 716, 717, 718

Dimensions: in / (mm)





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WIRING PRACTICES

General Wiring Practices

Good wiring practice requires the separation of control circuit wiring from all power (line and load) wiring. Power wiring to the motor must have the maximum possible separation from all other power wiring, whether from the same drive or other drives. **Do not run in the same conduit;** this separation reduces the possibility of coupling electrical noise between circuits.

When wiring ALTIVAR 66 drive controllers, follow the wiring practices required by national and local electrical codes in addition to the following:

- When using metallic conduit with ATV66U41N4 to D23N4 and ATV66U41M2 to D16M2 drive controllers, you must also use a metal conduit entry plate, kit VY1A66201. This kit mounts in place of the existing plastic plate and is held in place with two screws. A bond wire, which must be connected to ground (GND) on the J2 terminal strip, is included.
- Use metallic conduit for all drive controller wiring. Do not run control and power wiring in the same conduit.
- Separate metallic conduits carrying power wiring or low-level control wiring by at least 3 in (8 cm).
- Separate non-metallic conduits or cable trays used to carry power wiring from metallic conduit carrying low-level control wiring by at least 12 in (30.5 cm).
- Cross the metallic conduits and non-metallic conduits at right angles whenever power and control wiring cross.
- Attenuate conducted emissions to the line from the drive controller in some installations to prevent interference with telecommunication, radio, and sensitive electronic equipment. Such instances may require attenuating filters. Consult catalog for selection and application of these filters.

Branch Circuit Connections

All ALTIVAR 66 drive controllers require fuse protection. ATV66U41N4 to D79N4 and ATV66U41M2 to D46M2 drive controllers require user-supplied external fuses as indicated on the nameplate and in the Equipment Recommendations on pages 78 to 80. ATV66C10N4 to C19N4 drive controllers have provisions for mounting the user-supplied fuses internally (refer to the controller nameplate or the Equipment Recommendations on pages 78 to 80 for recommended fuses). ATV66C23N41 to C31N41 drive controllers are shipped with fuses. See page 79 for information on replacing fuses in ATV66C10N4 to ATV66C31N41 drive controllers.

Refer to NEC Article 430 for sizing branch circuit conductors.

Input Line Currents for Selecting Branch Circuit Conductors, 460 V CT

NOTE: The input conductor ampacity rating should not be less than the ampacity rating selected, based on the rated controller output current.

Motor Power		Drive Controller	Output Current	Input Line Current				
				5,000 AIC 0.141 mH 10,000 AIC [1] 0.070 mH 18,000 AIC [2] 0.039 mH	22,000 AIC 0.032 mH	65,000 AIC 0.011 mH	With Line Impedance of	
kW 400 V 50 Hz	hp 460 V 60 Hz						3%	5%
			A	A	A	A	A	A
0.75	—	ATV66U41N4	2.3	—	4.0	—	—	—
—	1		1.8	2.7	3.2	3.5	1.6	1.5
1.5	—		4.1	—	3.5	—	—	—
—	2		3.4	4.7	5.7	6.4	3.0	2.7
2.2	—		5.8	—	9.0	—	—	—
—	3		4.8	6.5	8.0	8.8	4.2	3.9
3	—	ATV66U54N4	7.8	—	12	—	—	—
4	—	ATV66U72N4	10.5	—	15.0	—	—	—
—	5		7.6	9.8	11.9	13.2	6.7	6.2
5.5	—	ATV66U90N4	13	—	20.0	—	—	—
—	7.5		11	13.9	16.7	18.5	10.0	9.2

[1] 10,000 AIC denoted by asterisk (*).
[2] 18,000 AIC denoted by (†).

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Input Line Currents for Selecting Branch Circuit Conductors, 460 V CT (Continued)

NOTE: The input conductor ampacity rating should not be less than the ampacity rating selected, based on the rated controller output current.

Motor Power		Drive Controller	Output Current	Input Line Current				
				5,000 AIC 0.141 mH 10,000 AIC [1] 0.070 mH 18,000 AIC [2] 0.039 mH	22,000 AIC 0.032 mH	65,000 AIC 0.011 mH	With Line Impedance of	
kW 400 V 50 Hz	hp 460 V 60 Hz						3%	5%
			A	A	A	A	A	A
7.5 —	— 10	ATV66D12N4	17.6 14.0	— 17.6	26.0 21.4	— 24.7	— 13.0	— 12.0
11 —	— 15	ATV66D16N4	24.2 21.0	— 24.8	35.0 29.9	— 33.6	— 19.4	— 17.9
15 —	— 20	ATV66D23N4	33.0 27.0	— 31.9	45.0 38.7	— 44.8	— 26.0	— 23.6
22 —	— 30	ATV66D33N4	48.4 40.0	— 44.0	60.0 52.4	— 59.7	— 37.0	— 34.2
30 —	— 40	ATV66D46N4	66.0 52.0	— 57.1	78.0 67.6	— 76.6	— 49.0	— 45.6
37 —	— 50	ATV66D54N4	79.2 65.0	— 68.3	94.0 80.8	— 91.9	— 61.2	— 56.3
45 —	— 60	ATV66D64N4	93.5 77.0	— 86.4*	110 94.6	— 108	— 71.6	— 66.7
55 —	— 75	ATV66D79N4	115.5 96.0	— 106*	130 116	— 133	— 90.1	— 83.5
75 —	— 100	ATV66C10N4	157 124	— 138*	171 151	— 173	— 121	— 113
90 —	— 125	ATV66C13N4	190 156	— 166*	198 186	— 211	— 153	— 143
110 —	— 150	ATV66C15N4	226 180	— 191*	237 217	— 246	— 182	— 170
132 —	— 200	ATV66C19N4	270 240	— 242*	275 277	— 314	— 238	— 223
160 —	— 250	ATV66C23N41	330 300	— 318†	326 333	— 379	— 295	— 276
200 —	— 300	ATV66C28N41	407 360	— 366†	399 379	— 441	— 352	— 328
220 —	— 350	ATV66C31N41	449 420	— 419†	421 431	— 506	— 410	— 383

[1] 10,000 AIC denoted by asterisk (*).
[2] 18,000 AIC denoted by (†).

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Input Line Currents for Selecting Branch Circuit Conductors, 460 V VT

NOTE: The input conductor ampacity rating should not be less than the ampacity rating selected, based on the rated controller output current.

Motor Power		Drive Controller	Output Current	Input Line Current				
				5,000 AIC 0.141 mH 10,000 AIC [1] 0.070 mH 18,000 AIC [2] 0.039 mH	22,000AIC 0.032 mH	65,000 AIC 0.011 mH	With Line Impedance of	
kW 400 V 50 Hz	hp 460 V 60 Hz						3%	5%
			A	A	A	A	A	A
0.75	—	ATV66U41N4	2.0	—	4.0	—	—	—
—	1		1.8	2.7	3.2	3.5	1.6	1.5
1.5	—		3.7	—	6.5	—	—	—
—	2		3.4	4.7	5.7	6.4	3.0	2.7
2.2	—		5.3	—	9.0	—	—	—
—	3		4.8	6.5	8.0	8.8	4.2	3.9
3	—		7.1	—	12.0	—	—	—
4	—	ATV66U54N4	9.5	—	16.0	—	—	—
—	5		7.6	9.8	11.9	13.2	6.7	6.2
5.5	—	ATV66U72N4	11.8	—	20.0	—	—	—
—	7.5		11.0	14.0	17.0	18.4	10.0	9.2
7.5	—	ATV66U90N4	16.0	—	25.0	—	—	—
—	10		14.0	17.7	21.4	23.4	13.0	12.0
11	—	ATV66D12N4	22.0	—	36.0	—	—	—
—	15		21.0	25.1	30.6	35.3	19.4	17.9
15	—	ATV66D16N4	30.0	—	45.0	—	—	—
—	20		27.0	31.8	38.3	42.9	26.0	23.6
18.5	—	ATV66D23N4	37.0	—	57.0	—	—	—
—	25		34.0	38.7	47.0	54.6	31.1	30.1
30	—	ATV66D33N4	60.0	—	79.0	—	—	—
—	40		52.0	57.1	67.6	76.6	49.0	45.6
37	—	ATV66D46N4	72.0	—	94.0	—	—	—
—	50		65.0	68.6	81.2	91.9	61.2	56.3
45	—	ATV66D54N4	85.0	—	112	—	—	—
—	60		77.0	86.4*	94.6	108	71.6	66.7
55	—	ATV66D64N4	105	—	130	—	—	—
—	75		96.0	106*	116	133	90.1	83.5
75	—	ATV66D79N4	143	—	176	—	—	—
—	100		124	138*	150	171	121	113
90	—	ATV66C10N4	190	—	199	—	—	—
—	125		156	165*	185	210	153	143
110	—	ATV66C13N4	226	—	238	—	—	—
—	150		180	191*	217	246	182	170
132	—	ATV66C15N4	270	—	278	—	—	—
—	200		240	242*	277	314	238	223
160	—	ATV66C23N41	330	—	336	—	—	—
—	250		300	317†	333	379	295	276
200	—		407	—	399	—	—	—
—	300		360	367†	381	443	352	328
220	—	ATV66C28N41	449	—	428	—	—	—
—	350		420	419†	431	506	410	383
250	—	ATV66C31N41	460	—	472	—	—	—
—	400		477	472†	484	571	467	438

[1] 10,000 AIC denoted by asterisk (*).
[2] 18,000 AIC denoted by (†).

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Input Line Currents for Selecting Branch Circuit Conductors, 460 V VTLN

NOTE: Note: The input conductor ampacity rating should not be less than the ampacity rating selected, based on the rated controller output current.

Motor Power		Drive Controller	Output Current	Input Line Current				
				5,000 AIC 0.141 mH 10,000 AIC [1] 0.070 mH	22,000 AIC 0.032 mH	65,000 AIC 0.011 mH	With Line Impedance of	
kW 400 V 50 Hz	hp 460 V 60 Hz						3%	5%
			A	A	A	A	A	A
0.75	—	ATV66U41N4	2.0	—	4.0	—	—	—
—	1		1.8	2.7	3.2	3.5	1.6	1.5
1.5	—		3.7	—	6.5	—	—	—
—	2		3.4	4.7	5.7	6.4	3.0	2.7
2.2	—		5.3	—	9.0	—	—	—
—	3		4.8	6.5	8.0	8.8	4.2	3.9
3	—	ATV66U54N4	7.1	—	12.0	—	—	—
4	—	ATV66U72N4	9.5	—	15.0	—	—	—
—	5		7.6	9.8	11.9	13.2	6.7	6.2
5.5	—	ATV66U90N4	11.8	—	20.0	—	—	—
—	7.5		11.0	13.9	16.7	18.5	10.0	9.2
7.5	—	ATV66D12N4	16.0	—	26.0	—	—	—
—	10		14.0	17.6	21.4	24.7	13.0	12.0
11	—	ATV66D16N4	22	—	35.0	—	—	—
—	15		21	24.8	29.9	33.6	19.4	17.9
15	—	ATV66D23N4	30	—	45.0	—	—	—
—	20		27	31.9	38.7	44.8	26.0	23.6
22	—	ATV66D33N4	44	—	60.0	—	—	—
—	30		40	44.0	52.4	59.7	37.0	34.2
30	—	ATV66D46N4	60	—	78.0	—	—	—
—	40		52	57.1	67.6	76.6	49.0	45.6
37	—	ATV66D54N4	72	—	94.0	—	—	—
—	50		65	68.3	80.8	91.9	61.2	56.3
45	—	ATV66D64N4	85	—	110	—	—	—
—	60		77	86.4*	94.6	108	71.6	66.7
55	—	ATV66D79N4	105	—	130	—	—	—
—	75		96	106*	116	133	90.1	83.5

[1] 10,000 AIC denoted by asterisk (*).

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Input Line Currents for Selecting Branch Circuit Conductors, 208-230 V CT

NOTE: The input conductor ampacity rating should not be less than the ampacity rating selected, based on the rated controller output current.

Motor Power 208/230 V 50/60 Hz		Drive Controller	Output Current	Input Line Current						
				208 V 8,800 AIC 0.036 mH	230 V		With Line Impedance of			
							208 V		230 V	
					5,000 AIC 0.070 mH	22,000 AIC 0.016 mH	3%	5%	3%	5%
kW	hp		A	A	A	A	A	A	A	A
0.75	1	ATV66U41M2	4.0	5.7	4.8	5.7	3.5	3.3	3.5	3.0
1.5	2		7.5	10.1	8.6	10.2	6.4	6.2	6.0	5.6
2.2	3		10.6	14.1	11.9	14.1	9.2	8.9	8.5	8.1
4	5	ATV66U72M2	16.7	21.4	18.0	21.5	14.7	14.3	14.0	12.9
5.5	7.5	ATV66U90M2	24.2	30.4	25.6	30.5	22.0	21.3	20.1	19.3
7.5	10	ATV66D12M2	30.8	38.6	32.6	38.7	29.0	27.8	26.5	25.2
11	15	ATV66D16M2	46.2	54.7	46.2	54.8	43.0	41.1	38.7	37.2
15	20	ATV66D23M2	59.4	69.4	58.8	69.5	57.0	54.1	50.4	49.0
20	30	ATV66D33M2	88.0	97.6	81.1	97.6	83.0	79.8	74.0	72.0
30	40	ATV66D46M2	114	124.2	102.1	125.4	109.1	105.4	98.7	95.6

Input Line Currents for Selecting Branch Circuit Conductors, 208-230 VT

NOTE: The input conductor ampacity rating should not be less than the ampacity rating selected, based on the rated controller output current.

Motor Power 208/230 V 50/60 Hz		Drive Controller	Output Current	Input Line Current						
				208 V 8,800 AIC 0.036 mH	230 V		With Line Impedance of			
							208 V		230 V	
					5,000 AIC 0.070 mH	22,000 AIC 0.016 mH	3%	5%	3%	5%
kW	hp		A	A	A	A	A	A	A	A
0.75	1	ATV66U41M2	4.0	5.7	4.8	5.7	3.5	3.3	3.5	3.0
1.5	2		7.5	10.1	8.6	10.2	6.4	6.2	6.0	5.6
2.2	3		10.6	14.1	11.9	14.1	9.2	8.9	8.5	8.1
5.5	7.5	ATV66U72M2	24.2	30.6	25.8	30.6	22.0	21.3	20.1	19.3
7.5	10	ATV66U90M2	30.8	38.8	32.7	38.8	29.0	27.8	26.5	25.2
11	15	ATV66D12M2	46.2	54.7	46.2	54.8	43.0	41.1	38.7	37.2
15	20	ATV66D23M2	59.4	69.3	58.7	69.4	57.0	54.1	50.4	49.0
18.5	25		74.8	84.4	71.5	84.4	69.2	67.2	64.0	60.9
30	40	ATV66D33M2	114	124.9	102.7	125.9	109.1	105.4	98.7	95.6
37	50	ATV66D46M2	143	149.3	122.6	151.1	134.0	129.6	121.0	117.4

Input Line Currents for Selecting Branch Circuit Conductors, 208/230 V VTLN

NOTE: The input conductor ampacity rating should not be less than the ampacity rating selected, based on the rated controller output current.

Motor Power 208/230 V 50/60 Hz		Drive Controller	Output Current	Input Line Current						
				208 V 8,800 AIC 0.036 mH	230 V		With Line Impedance of			
							208 V		230 V	
					5,000 AIC 0.070 mH	22,000 AIC 0.016 mH	3%	5%	3%	5%
kW	hp		A	A	A	A	A	A	A	A
0.75	1	ATV66U41M2	4.0	5.8	5.4	6.4	3.5	3.3	3.5	3.0
1.5	2		7.5	10.4	8.8	10.4	6.4	6.2	6.0	5.6
2.2	3		10.6	14.3	12.0	14.3	9.2	8.9	8.5	8.1

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Input Line Currents for Selecting Branch Circuit Conductors, 208/230 V VTLN (Continued)

NOTE: The input conductor ampacity rating should not be less than the ampacity rating selected, based on the rated controller output current.

Motor Power 208/230 V 50/60 Hz		Drive Controller	Output Current	Input Line Current						
				208 V 8,800 AIC 0.036 mH	230 V		With Line Impedance of			
					5,000 AIC 0.070 mH	22,000 AIC 0.016 mH	208 V		230 V	
							3%	5%	3%	5%
kW	hp		A	A	A	A	A	A	A	A
4	5	ATV66U72M2	16.7	21.8	18.3	21.8	14.7	14.3	14.0	12.9
5.5	7.5	ATV66U90M2	24.2	30.6	25.8	30.7	22.0	21.3	20.1	19.3
7.5	10	ATV66D12M2	30.8	38.9	32.8	39.0	29.0	27.8	26.5	25.2
11	15	ATV66D16M2	46.2	55.1	46.5	55.2	43.0	41.1	38.7	37.2
15	20	ATV66D23M2	59.4	70.3	59.6	70.3	57.0	54.1	50.4	49.0
22	30	ATV66D33M2	88.0	97.2	80.8	97.2	83.0	79.8	74.0	72.0
30	40	ATV66D46M2	114	124.2	102.0	125.4	109.1	105.4	98.7	95.6

Control Wiring

Although all control inputs and outputs of the drive controller are isolated from the input lines, you must follow certain control wiring precautions:

- Keep control wiring conductor runs short and direct. Follow the conduit and circuit separation requirements listed throughout this section.
- Make sure that the control contacts used with the drive controller inputs are rated for operation at open circuit voltages of 24 VDC and closed circuit currents of 10 mADC.
- Analog inputs and outputs require twisted cable with a pitch of 1 to 2 inches. Use of a cable shield is recommended. The shield must be terminated to ground at one end only. It is recommended that the shield be terminated at the drive controller. Shield connection terminals are provided on the ALTIVAR 66 drive controller for this purpose.
- Make sure that the coils of all relays and solenoids connected to the output contacts of the drive controller are equipped with appropriate transient suppressors.
- For proper control wiring, route conductors to avoid contact with other voltage potentials in the drive controller. Wire insulation must have the appropriate voltage rating for the voltage present. The ATV66C10N4 to C31N41 drive controllers are equipped with control wiring channels to allow routing of control conductors away from power circuit conductors. The channels are located on the right side of ATV66C10N4 to C19N4 controllers, and on the left side of ATV66C23N41 to C31N41 controllers.

Output Wiring

The drive controller is sensitive to the amount of capacitance (either phase-to-phase or phase-to-ground) present on the output power conductors. If excessive capacitance is present, the drive controller may trip. Follow the guidelines below when selecting output cable:

- Cable type: the cable selected must have a low capacitance phase-to-phase and to ground. Do not use mineral impregnated cable because it has a very high capacitance. Immersion of cables in water increases capacitance.
- Cable length: the longer the cable, the greater the capacitance. Cable lengths greater than 320 ft (100 m) may require analysis to determine if mitigation is required. Contact your local ALTIVAR representative.
- Proximity to output cables from other drive controllers: because of the high frequency switching and increased capacitance, the drive may fault under some conditions.
- Do not use lightning arrestors or power factor correction capacitors on output of drive controller.
- For installation where cable capacitances may be a problem, an inductor can be installed between the drive controller and the motor. Consult factory for additional information.

Grounding

For safe, dependable operation, drives must be grounded according to national and local codes. Ground the drive as shown in the instruction manual.

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Recommended Equipment for 1 to 400 hp 460 V Drive Controllers[1]

M1 Motor		A1 Controller ATV66•••N4		F1-F3 Line Power Fuses Ratings, Fuse Class				Input	KM1	TS	T1	F7, F8	F9
kW	hp	CT,VT low noise	VT	CC Fast Acting	T	Littelfuse JLS-[9]	Gould-Shawmut A4J-[9]	Fuse Carriers Class T or CC	Line Contactor	Transient Suppressor	Xfmr [8]	Primary Xfmr Fuses [3]	Sec. Xfmr Fuses [3]
0.75	1	U41	U41	600 V 6 A	600 V 6 A	600 V 6 A	—	9080-FB3611CC[2] T60060-3CR[3]	LC1-D2510G6	LA4-DA2G	9070-K50D20	FNQ-R-1/4	FNQ-R-1/2
1.5	2	U41	U41	600 V 10 A	600 V 10 A	600 V 10 A	—	9080-FB3611CC[2] T60060-3CR[3]	LC1-D2510G6	LA4-DA2G	9070-K50D20	FNQ-R-1/4	FNQ-R-1/2
2.2	3	U41	U41	600 V 15 A	600 V 15 A	600 V 15 A	—	9080-FB3611CC[2] T60060-3CR[3]	LC1-D2510G6	LA4-DA2G	9070-K50D20	FNQ-R-1/4	FNQ-R-1/2
3	4	U54	U41	600 V 20 A	600 V 20 A	600 V 20 A	—	9080-FB3611CC[2] T60060-3CR[3]	LC1-D2510G6	LA4-DA2G	9070-K50D20	FNQ-R-1/4	FNQ-R-1/2
4	5	U72	U54	600 V 20 A	600 V 20 A	600 V 20 A	—	9080-FB3611CC[2] T60060-3CR[3]	LC1-D2510G6	LA4-DA2G	9070-K50D20	FNQ-R-1/4	FNQ-R-1/2
5.5	7.5	—	U72	600 V 25 A	600 V 25 A	600 V 25 A	—	9080-FB3611CC[2] T60060-3CR[3]	LC1-D2510G6	LA4-DA2G	9070-K50D20	FNQ-R-1/4	FNQ-R-1/2
5.5	7.5	U90	—	—	600 V 30 A	600 V 30 A	600 V 30 A	T60060-3CR[3]	LC1-D2510G6	LA4-DA2G	9070-K50D20	FNQ-R-1/4	FNQ-R-1/2
7.5	10	D12	U90	—	600 V 35 A	600 V 35 A	600 V 35 A	T60060-3CR[3]	LC1-D2510G6	LA4-DA2G	9070-K50D20	FNQ-R-1/4	FNQ-R-1/2
11	15	—	D12	—	600 V 60 A	600 V 45 A	600 V 45 A	T60060-3CR[3]	LC1-D2510G6	LA4-DA2G	9070-K50D20	FNQ-R-1/4	FNQ-R-1/2
11	15	D16	—	—	600 V 60 A	600 V 60 A	600 V 60 A	T60060-3CR[3]	LC1-D2510G6	LA4-DA2G	9070-K50D20	FNQ-R-1/4	FNQ-R-1/2
15	20	D23	D16	—	600 V 70 A	600 V 70 A	600 V 70 A	T60100-3C[3]	LC1-D3210G6	LA4-DA2G	9070-K50D20	FNQ-R-1/4	FNQ-R-1/2
18.5	25	—	D23	—	600 V 90 A	600 V 90 A	600 V 80 A	T60100-3C[3]	LC1-D4011G6	LA4-DA2G	9070-K75D20	FNQ-R-3/10	FNQ-R-6/10
22	30	D33	—	—	600 V 90 A	600 V 90 A	600 V 90 A	T60100-3C[3]	LC1-D5011G6	LA4-DA2G	9070-K75D20	FNQ-R-3/10	FNQ-R-6/10
30	40	D46	D33	—	600 V 125 A	600 V 125 A	600 V 110 A	3 ea. T60200-1C[3]	LC1-D8011G6	LA4-DA2G	9070-K75D20	FNQ-R-3/10	FNQ-R-6/10
37	50	D54	D46	—	600 V 125 A	600 V 125 A	600 V 110 A[10]	3 ea. T60200-1C[3]	LC1-D8011G6	LA4-DA2G	9070-K75D20	FNQ-R-3/10	FNQ-R-6/10
45	60	D64	D54	—	600 V 175 A	600 V 175 A	600 V 175 A	3 ea. T60200-1C[3]	LC1-F115G6	LA9-F980	9070-K200D20	FNQ-R-1-1/4	FNQ-R-1-6/10
55	75	D79	D64	—	600 V 200 A	600 V 200 A	600 V 200 A	3 ea. T60200-1C[3]	LC1-F115G6	LA9-F980	9070-K200D20	FNQ-R-1-1/4	FNQ-R-1-6/10
75	100	—	D79	—	600 V 225 A	600 V 225 A	600 V 225 A	3 ea. T60400-1C[3]	LC1-F150G6	LA9-F980	9070-K200D20	FNQ-R-1-1/4	FNQ-R-1-6/10

[1] For F10 and F11, use Bussmann control fuse KTK-R-3. The recommended control fuse carrier is 9080-FB2611CC.
[2] Square D Class CC Fuse Block numbers.
[3] Bussmann part numbers.
[4] Gould-Shawmut part numbers.
[5] Ferraz part numbers.
[6] Fuse mounted inside drive controller.
[7] The power circuit configuration of the ATV66C23N4 to ATV66C31N4 drive controllers does not support the use of an input isolation contactor.
[8] T1 has been dimensioned to supply KM1 coil inrush and sealed VA requirements only. Any user control / pilot device additions may require re-dimensioning of T1 VA capacity.
[9] Manufacturer-specific fuse selection. DO NOT SUBSTITUTE.
[10] 125 A rating allowable for ATV66D54N4 controller.

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Recommended Semiconductor Fuses for 1 - 400 hp 460 V Controllers

M1 Motor		A1 Controller ATV66•••N4		F1-F3	Input	KM1	TS	T1	F7, F8	F9
kW	hp	CT, VT low noise	VT	Line Power Fuses Semiconductor Fuse Class	Fuse Carriers [3]	Line Contactor	Transient Suppressor	Xfmr [8]	Primary Xfmr Fuses [3]	Sec. Xfmr Fuses [3]
75	100	C10	—	FWH400A[3] A50P400[4]	6 ea. BH-1133	LC1-F150G6	LA9-F980	9070-K200D20	FNQ-R-1-1/4	FNQ-R-1-6/10
90	125	C13	C10	FWH400A[3] A50P400[4]	6 ea. BH-1133	LC1-F265G7	LA9-F980	9070-K350D20	FNQ-R-1-6/10	FNQ-R-2-8/10
110	150	C15	—	FWH500A[3] A50P500[4]	6 ea. BH-3245	LC1-F265G7	LA9-F980	9070-K350D20	FNQ-R-1-6/10	FNQ-R-2-8/10
110	150	—	C13	FWH400A[3] A50P400[4]	6 ea. BH-1133	LC1-F265G7	LA9-F980	9070-K350D20	FNQ-R-1-6/10	FNQ-R-2-8/10
132	200	C19	—	FWH600A[3] A50P600 [4]	6 ea. BH-3245	LC1-F330G7	LA9-F980	9070-K250D20	FNQ-R-1-1/4	FNQ-R-2
132	200	—	C15	FWH500A[3] A50P500[4]	6 ea. BH-3245	LC1-F330G7	LA9-F980	9070-K250D20	FNQ-R-1-1/4	FNQ-R-2
160	250	C23	C23	FWH700A[3] 170M6711[3] N300231[5]	[6]	[7]	[7]	[7]	[7]	[7]
200	300	C28	C23	FWH800A [3] 170M6712[3] P300232 [5]	[6]	[7]	[7]	[7]	[7]	[7]
220	350	C31	C28	FWH900A[3] 170M6713[3] Q300233 [5]	[6]	[7]	[7]	[7]	[7]	[7]
250	400	—	C31	FWH900A[3] 170M6713[3] Q300233[5]	[6]	[7]	[7]	[7]	[7]	[7]

[1] For F10 and F11, use Bussmann control fuse KTK-R-3. The recommended control fuse carrier is 9080-FB2611CC.
[2] Square D Class CC Fuse Block numbers.
[3] Bussmann part numbers.
[4] Gould-Shawmut part numbers.
[5] Ferraz part numbers.
[6] Fuse mounted inside drive controller.
[7] The power circuit configuration of the ATV66C23N4 to ATV66C31N4 drive controllers does not support the use of an input isolation contactor.
[8] T1 has been dimensioned to supply KM1 coil inrush and sealed VA requirements only. Any user control / pilot device additions may require re-dimensioning of T1 VA capacity.

Maximum Allowable Line Fuse (F1 to F3) for 460 V Drive Controllers

Controller ATV66•••N4	Class CC (Fast-Acting)	Class T	Littelfuse JLS- [4]	Gould-Shawmut A4J- [4]	Semiconductor
U41, U54, U72	600 V, 25 A	600 V, 35 A	600 V, 30 A	—	—
U90, D12	—	600 V, 60 A	600 V, 45 A	600 V, 45 A	—
D16, D23	—	600 V, 100 A	600 V, 100 A	600 V, 80 A	—
D33, D46	—	600 V, 125 A	600 V, 125 A	600 V, 110 A	—
D54, D64, D79	—	600 V, 225 A	600 V, 225 A	600 V, 225 A	—
C10	—	—	—	—	FWH500A [1] A50P500 [2]
C13, C15, C19	—	—	—	—	FWH600A [1] A50P600 [2]
C23, C28, C31	—	—	—	—	FWH900A [1] 170M6713 [2] Q300233 [3]

[1] Bussmann part numbers.
[2] Gould-Shawmut part numbers.
[3] Ferraz part numbers.
[4] Manufacturer-specific fuse selection. DO NOT SUBSTITUTE.

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Recommended Equipment for 1 to 50 hp 208/230 V Drive Controllers[1]

M1		A1		F1-F3				Input	KM1	TS	T1	F6, F7		F8
Motor		Controller ATV66•••M2		Line Power Fuses Ratings, Fuse Class								Primary Xfmr Fuses [2]		
kW	hp	CT, VT low noise	VT	CC Fast Acting	T	Littelfuse JLS- [5]	Gould-Shawmut A4J- [5]	Fuse Carriers Class T or CC	Line Contactor	Transient Suppressor	Xfmr [3]	208 V	230 V	Sec. Xfmr Fuses [2]
0.75	1	U41	U41	600 V 10 A	600 V 10 A	600 V 10 A	—	9080-FB3611CC [4] T60030-3CR[2]	LC1-D2510G6	LA4-DA2G	9070-K50D20	FNQ-R-1/2	FNQ-R-1/2	FNQ-R-1/2
1.2	1.5	U41	U41	600 V 15 A	600 V 15 A	600 V 15 A	—	9080-FB3611CC[4] T60030-3CR[2]	LC1-D2510G6	LA4-DA2G	9070-K50D20	FNQ-R-1/2	FNQ-R-1/2	FNQ-R-1/2
1.5	2	U41	U41	600 V 20 A	600 V 20 A	600 V 20 A	—	9080 FB3611CC[4] T60030-3CR[2]	LC1-D2510G6	LA4-DA2G	9070-K50D20	FNQ-R-1/2	FNQ-R-1/2	FNQ-R-1/2
2.2	3	U41	U41	600 V 25 A	600 V 25 A	600 V 25 A	—	9080-FB3611CC[4] T60030-3CR[2]	LC1-D2510G6	LA4-DA2G	9070-K50D20	FNQ-R-1/2	FNQ-R-1/2	FNQ-R-1/2
3	4	_	U41	600 V 25 A	600 V 25 A	600 V 25 A	—	9080-FB3611CC[4] T60030-3CR[2]	LC1-D2510G6	LA4-DA2G	9070-K50D20	FNQ-R-1/2	FNQ-R-1/2	FNQ-R-1/2
4	5	U72	U72	—	600 V 35 A	600 V 35 A	600 V 35 A	T60060-3C[2]	LC1-D2510G6	LA4-DA2G	9070-K50D20	FNQ-R-1/2	FNQ-R-1/2	FNQ-R-1/2
5.5	7.5	U90	U72	—	600 V 45 A	600 V 45 A	600 V 45 A	T60060-3C[2]	LC1-D2510G6	LA4-DA2G	9070-K50D20	FNQ-R-1/2	FNQ-R-1/2	FNQ-R-1/2
7.5	10	D12	U90	—	600 V 60 A	600 V 60 A	600 V 60 A	T60060-3C[2]	LC1-D3210G6	LA4-DA2G	9070-K50D20	FNQ-R-1/2	FNQ-R-1/2	FNQ-R-1/2
11	15	D16	D12	—	600 V 90 A	600 V 90 A	600 V 90 A	3 ea. T60100-1C[2]	LC1-D4010G6	LA4-DA2G	9070-K75D20	FNQ-R-1	FNQ-R-3/4	FNQ-R-6/10
15	20	D23	D23	—	600 V, 110 A	600 V 110 A	600 V 110 A	3 ea. T60200-1C [2]	LC1-D8011G6	LA4-DA2G	9070-K75D20	FNQ-R-1	FNQ-R-3/4	FNQ-R-6/10
18.5	25	D33	D23	—	600 V, 150 A	600 V 150 A	600 V 150 A	3 ea. T60200-1C [2]	LC1-D8011G6	LA4-DA2G	9070-K75D20	FNQ-R-1	FNQ-R-3/4	FNQ-R-6/10
22	30	D33	D33	—	600 V, 150 A	600 V 150 A	600 V 150 A	3 ea. T60200-1C [2]	LC1-D8011G6	LA4-DA2G	9070-K75D20	FNQ-R-1	FNQ-R-3/4	FNQ-R-6/10
30	40	D46	D33	—	600 V, 200 A	600 V 200 A	600 V 200 A	3 ea. T60200-1C [2]	LC1-F115G6	LA9-F980	9070-K200D20	FNQ-R-2-1/4	FNQ-R-1-6/10	FNQ-R-1-6/10
37	50	_	D46	—	600 V, 250 A	600 V 250 A	600 V 250 A	3 ea. T60400-1C [2]	LC1-F115G6	LA9-F980	9070-K200D20	FNQ-R-2-1/4	FNQ-R-1-6/10	FNQ-R-1-6/10

[1] For F10 and F11, use Bussmann control fuse KTK-R-3. The recommended control fuse carrier is 9080-FB2611CC.
[2] Bussmann part numbers.
[3] T1 has been dimensioned to supply KM1 coil inrush and sealed VA requirements only. Any user control / pilot device additions may require re-dimensioning of T1 VA capacity.
[4] Square D Class CC Fuse Block numbers.
[5] Manufacturer-specific fuse selection. DO NOT SUBSTITUTE.

Maximum Allowable Line Fuse (F1 to F3) for 208/230 V Drive Controllers

Controller ATV66•••M2	Class CC (Fast-Acting)	Class T	Littelfuse JLS- [1]	Gould-Shawmut A4J- [1]
U41	600 V, 25 A	600 V, 45 A	600 V, 35 A	600 V, 35 A
U72, U90	—	600 V, 100 A	600 V, 100 A	600 V, 80 A
D12, D16	—	600 V, 125 A	600 V, 125 A	600 V, 100 A
D23, D33	—	600 V, 225 A	600 V, 225 A	600 V, 225 A
D46	—	600 V, 250 A	600 V, 250 A	600 V, 250 A

[1] Manufacturer-specific fuse selection. DO NOT SUBSTITUTE.

Recommended Equipment for all Drive Controllers

R1	Potentiometer	9001 K2106
—	Push buttons	9001 KR1UH13
—	Control station enclosure (accepts R1 and two push buttons)	9001 KYAF3

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Select the proper ALTIVAR 66 drive by comparing the motor full load current to the nominal drive current shown in the tables on page 53-56. The drive current must be greater than or equal to the motor full load current. The motor horsepower size can be different than that of the drive; however, the following guidelines must be followed.

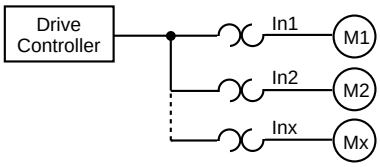
Motor Power Less than Drive Power

The ALTIVAR 66 drive can be used with a motor of lower power than that for which it was designed, however, the drive should only be one horsepower size greater than the motor. This association is a solution for applications which require high transient overtorque.

Motor Power Higher than Drive Power

An oversized motor can be used with the ALTIVAR 66 AC drive if the current absorbed by the motor is less than or equal to the nominal drive current and the motor is not operated continuously at a power level greater than the power rating of the drive. The motor should be no more than one horsepower size greater than that of the drive, for example a 2 hp drive with a 3 hp motor, where the motor full load current is less than that for a 2 hp drive.

Motors in Parallel



Ac drive selection:
- Ac drive In ≥ In1 + In2 + … Inx
- Ac drive Pn ≥ Pn1 + Pn2 + … Pnx
- Protect each motor with a thermal overload relay

In: rated current Pn: rated power

If several motors are run in parallel with one drive, nominal drive current must be higher than or equal to the sum of the currents of the motors connected to the drive. In this case, external thermal overload protection must be provided for each motor. In addition, the total continuous power rating of the connected motors must not exceed the power rating of the drive. If there are three or more motors in parallel, consult the factory.

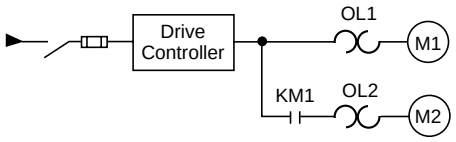
When several motors are run in parallel:

- If the motors are of equal power, optimal torque performance can be achieved after adjustment of drive parameters.
- If the motors are of different power, the drive parameters will not be correctly adjusted for the lower power motors and overtorque at low speed will be greatly reduced.

Overspeed Operation

It may be possible to run at speeds greater than motor nameplate speed; however, the motor manufacturer should be consulted before running in overspeed. Above a nominal speed of 50/60 Hz, the drive is incapable of producing additional output voltage. The available continuous motor torque will begin to decrease along with the motor maximum overtorque capability. Consult the motor manufacturer for continuous torque and overtorque capabilities of the motor to be used.

Additional Motor Connected Downstream of the Drive



If an additional motor is to be connected on the drive while the drive is running (slamming the motor), the sum of the running motor current(s) plus the expected starting current of the switched motor must not exceed 90% of the drive's transient output current rating. External thermal overload protection must be provided for each motor.

Use with Special Motors

The ALTIVAR 66 was designed for use with asynchronous motors; however, it can be used with other types of motors if certain conditions are met.

Synchronous permanent magnet or wound-field motors may be used if slip compensation is disabled, external overload protection is provided, the control type is set to Special, and appropriate field excitation and protection is provided for externally-excited motors.

Synchronous reluctance motors may be used; slip compensation must be disabled and the control type must be set to Special.

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Using a Synchronous Permanent Magnet or Wound-Field Motor

It is possible to operate a synchronous permanent magnet or synchronous wound-field motor as long as the following conditions are met:

- Slip compensation is disabled.
- Internal overload protection is disabled and external protection (overload relay or thermal sensor) is used.
- Operation is only with Special control type with constant torque setting.
- Appropriate field excitation and protection is provided for externally-excited motors.

Using a Synchronous Reluctance Motor

It is possible to operate a synchronous reluctance motor as long as slip compensation is disabled.

Operating Non-Standard Motors

Description	Slip Compensation	Overload	Control Type
Motors in parallel	Disable	Disable [1]	Special
Additional motor	Enable	Disable [1]	Special
Synchronous permanent magnet	Disable	Disable [1]	Special
Synchronous wound field	Disable	Disable [1]	Special
Synchronous reluctance	Disable	Enable	Special

[1] An external thermal overload relay is required if the AC drive protection is disabled.

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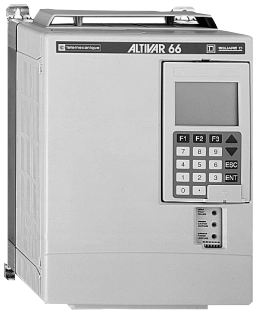

Drives 1 to 350 HP (0.75 - 132 kW), 400/460 V Three Phase Input - 50/60 Hz

Motor		**ALTIVAR 66 Drive**
Nameplate Power (constant torque application)		**Catalog Number**
HP	**kW**	
1-2-3	0.75-1.5-2.2	ATV66U41N4U
-	3	ATV66U54N4U
5	4	ATV66U72N4U
7.5	5.5	ATV66U90N4U
10	7.5	ATV66D12N4U
15	11	ATV66D16N4U
20	15	ATV66D23N4U
30	22	ATV66D33N4U
40	30	ATV66D46N4U
50	37	ATV66D54N4U
60	45	ATV66D64N4U
75	55	ATV66D79N4U
100	75	ATV66C10N4U
125	90	ATV66C13N4U
150	110	ATV66C15N4U
200	132	ATV66C19N4U
250	160	ATV66C23N41
300	200	ATV66C28N41
350	220	ATV66C31N41

Drives 1 to 40 HP (0.75 to 30 kw) 208/230 V Three Phase Input - 50/60 Hz

Motor		**ALTIVAR 66 Drive**
Nameplate Power (constant torque application)		**Catalog Number**
HP	**kW**	
1-2-3	0.75-1.5-2.2	ATV66U41M2
5	4	ATV66U72M2
7.5	5.5	ATV66U90M2
10	7.5	ATV66D12M2
15	11	ATV66D16M2
20	15	ATV66D23M2
30	22	ATV66D33M2
40	30	ATV66D46M2

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Options and Accessories

VW3A6620•

Description	For Drives	Catalog Number
Keypad door mounting kit with 2 m cable	ATV66 all ranges	VW3A66100
Keypad door mounting kit with 3 m cable	ATV66 all ranges	VW3A66101
Eight Operator Control Island [1]	ATV66 all ranges	VW3A66102
Six Operator, One Meter Control Island [1]	ATV66 all ranges	VW3A66103
Four Operator, Two Meter Control Island [1]	ATV66 all ranges	VW3A66104
I/O Extension Module, 24 V	ATV66 all ranges	VW3A66201T
I/O Extension Module, 115 V	ATV66 all ranges	VW3A66202T
3 m Cable for remote mounting of keypad display	ATV66 all ranges	VW3A66311
2 m Cable for remote mounting of keypad display	ATV66 all ranges	VW3A66312
PC Connection Option	ATV66 all ranges	VW3A66331U
Service and Troubleshooting Manual	ATV66 all ranges	VD0C06S701
RFI Filters [3]	ATV66U41N4 (1–2 HP)	VW3A66401U
	ATV66U41N4 (3 HP), U54N4	VW3A66402U
	ATV66U72N4, U90N4, D12N4	VW3A66404U
	ATV66D16N4, D23N4	VW3A66405U
	ATV66D33N4, D46N4	VW3A66406U
Dynamic Braking Resistor with Type 1 Enclosure	ATV66U41N4, U54N4, U72N4	VW3A66711
	ATV66U90N4, D12N4	VW3A66712
	ATV66D16N4, D23N4	VW3A66713
	ATV66D33N4, D46N4	VW3A66714
	ATV66D54N4	VW3A66715
	ATV66D64N4, D79N4	VW3A66716
	ATV66C10N4, C13N4, C15N4, C19N4	VW3A66717
	ATV66C23N4 [4]	VW3A66718 [5]
	ATV66C28N4, C31N4 [4]	VW3A66717 [5]
Gasket Kit for Recess Mounting	ATV66U41N4 to U72N4, ATV66U41M2	VW3A66801T
	ATV66U90N4 to D12N4, U72M2, U90M2	VW3A66802T
	ATV66D16N4 to D23N4, D12M2 to D16M2	VW3A66803
Mounting Adapter Plate for Recess Mounting	ATV66U41N4-U72N4	VW3A66806
	ATV66U41M2	
	ATV66U90N4-D12N4	VW3A66807
	ATV66U72M2, U90M2	
	ATV66D16N4-D23N4	VW3A66808
	ATV66D12M2, D16M2	
Memory Card	All ATV66 drives	VW3A66901T
Metal Conduit Entry Plate	ATV66U41N4-D23N4	VY1A66201
	ATV66U41M2-D16M2 For wall-mounted drives when metallic conduit is used	
Dynamic Braking Resistor Mounting Plate	ATV66C23N4 to ATV66C31N4	VY1A66202
Communication Card for UNI-TELWAY MODBUS RTU/JBUS, MODBUS ASCII Networks [2]	All ATV66 drives	VW3A66301U
Communication Card for MODBUS Plus Network[2]	All ATV66 drives	VW3A66305U
Communication Card Carrier	ATV66 all ranges	VW3A66205

[1] Designed for use with Telemecanique Type ZA2B 22mm operators and 2-1/2"" surface mount meters. When used with compatible operators and meters and the enclosed gasket, control island kit maintains Type 12 / IP54 integrity of enclosure sidewall.
[2] For use with an I/O extention module or communication card carrier.
[3] RFI filters are for use on equipment being designed for European power systems where CE compliance is required. Reference catalog VVDED296034 for more information, and a larger selection of filters.
[4] Mounting the dynamic braking resistor assemblies on the ATV66C23N4 to C31N4 AC Drives requires the use of the Dynamic Braking Resistor Mounting Plate Kit VY1A66202.
[5] Order quantity of 2. Two kits required on these units.

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Spare Parts List

Description	Drive Controller	Reference No.	Note
ALTIVAR 66 Adjustable Frequency Drive Controller Service and Troubleshooting Manual	ATV66 all sizes	VD0C06S701_	
Control Kit — 460 V	ATV66U41N4 to D79N4 ATV66C10N4 to C31N41	VX4A66CK1 VX4A66CK2	Matched keypad and control basket with latest firmware
Control Kit — 208/230 V	ATV66U41M2 to D46M2* *ATV66D23M2S264U	VX4A66CK1 VX4A66CK1S260	Matched keypad and control basket with latest firmware
Keypad display (for drive controllers with firmware level 3.0 and later — see Chapter 4 section “Identifying the Firmware Version”)	ATV66 all sizes	VW3A66206U	For drive controllers with firmware earlier than 3.0, order the control kit listed above
Removable Control Terminal Strips	ATV66 all sizes	VZ3N006	J1, J12 and J13 on control basket
Power Board — 460 V	ATV66U41N4 (Serial number ends in code “A21” and earlier — see Chapter 1 section “Nameplates and Serial Numbers”)	VX5A66U41N4	Includes IGBT block, rectifier diode, heatsink, and fan
	ATV66U41N4 (Serial number ends in code “A22” and later — see Chapter 1 section “Nameplates and Serial Numbers”)	VX5A663U41N4	Includes IGBT block and rectifier diode
	ATV66U54N4	VX5A662U54N4	Includes IGBT block and rectifier diode
	ATV66U72N4	VX5A662U72N4	Includes IGBT block and rectifier diode
	ATV66U90N4	VX5A662U90N4	Includes IGBT block and rectifier diode
	ATV66D12N4	VX5A662D12N4	Includes IGBT block and rectifier diode
	ATV66D16N4	VX5A66D16N4	
	ATV66D23N4	VX5A66D23N4	
	ATV66D33N4	VX5A66D33N4	
	ATV66D46N4	VX5A66D46N4	
	ATV66D54N4	VX5A66D54N4	
	ATV66D64N4	VX5A66D64N4	
	ATV66D79N4	VX5A66D79N4	
	ATV66C10N4	VX5A661C10N4	
	ATV66C13N4	VX5A661C13N4	
	ATV66C15N4	VX5A661C15N4	
	ATV66C19N4	VX5A661C19N4	
	ATV66C23N41	VX5A661C23N4	
	ATV66C28N41	VX5A661C28N4	
	ATV66C31N41	VX5A661C31N4	
Power Board — 208/230 V	ATV66U41M2	VX5A662U41M2	Includes IGBT block and rectifier diode
	ATV66U72M2	VX5A662U72M2	Includes IGBT block and rectifier diode
	ATV66U90M2	VX5A662U90M2	Includes IGBT block and rectifier diode
	ATV66D12M2	VX5A66D12M2	
	ATV66D16M2	VX5A66D16M2	
Power Board and Gate Driver Board — 208/230 V	ATV66D23M2	VX5A66D234M2	Matched set
	ATV66D33M2	VX5A66D335M2	Matched set
	ATV66D46M2	VX5A66D466M2	Matched set
Gate Driver Board — 460 V	ATV66D16N4	VX5A66103	
	ATV66D23N4	VX5A66104	
	ATV66D33N4	VX5A66105	
	ATV66D46N4	VX5A66106	
	ATV66D54N4	VX5A66107	
	ATV66D64N4	VX5A66108	
	ATV66D79N4	VX5A66109	
Gate Driver Board — 208/230 V	ATV66D12M2	VX5A66112	
	ATV66D16M2	VX5A66113	

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Spare Parts List (Continued)

Description	Drive Controller	Reference No.	Note
Inverter IGBT — 460 V	ATV66D16N4	VZ3IM2050M1201	1 dual IGBT block
	ATV66D23N4	VZ3IM2075M1201	1 dual IGBT block
	ATV66D33N4	VZ3IM2100M1201	1 dual IGBT block
	ATV66D46N4, D54N4	VZ3IM2150M1201	1 dual IGBT block
	ATV66D64N4	VZ3IM2200M1201	1 dual IGBT block
	ATV66D79N4	VZ3IM2300M1201	1 dual IGBT block
	ATV66C10N4	VZ3IM2300M1202	2 dual IGBT blocks, snubber boards, gate driver boards, 1 clamp module
	ATV66C13N4 to C19N4	VZ3IM2400M1202	2 dual IGBT blocks, snubber boards, gate driver boards, 1 clamp module
	ATV66C23N41, C28N41	VZ3IM1400M1207	4 dual IGBT blocks, snubber boards, gate driver boards
	ATV66C31N41	VZ3IM1500M1207	4 dual IGBT blocks, snubber boards, gate driver boards
Inverter IGBT — 208/230 V	ATV66D12M2	VZ3IM2075M0601	1 dual IGBT block
	ATV66D16M2	VZ3IM2100M0601	1 dual IGBT block
	ATV66D23M2	VZ3IM2150M0601	1 dual IGBT block
	ATV66D33M2	VZ3IM2200M0601	1 dual IGBT block
	ATV66D46M2	VZ3IM2300M0601	1 dual IGBT block
Inverter IGBT Clamp Capacitor	ATV66C23N41 to C31N41	VY1ADC610	
Dynamic Braking IGBT — 460 V	ATV66D14N4, D23N4	VZ3IM1025M1001	
	ATV66D33N4, D46N4	VZ3IM2050M1201	
	ATV66D54N4	VZ3IM2100M1201	
	ATV66D64N4, D79N4	VZ3IM2150M1201	
	ATV66C10N4 to C19N4	VZ3IM1300M1202	1 dual IGBT block, 1 dual diode block, 1 snubber board, 1 gate driver board
	ATV66C23N41	VZ3IM1400M1208	1 dual IGBT block, 1 dual diode block, 1 snubber board, 1 gate driver board
	ATV66C28N41, C31N41	VZ3IM1300M1208	2 dual IGBT blocks, 2 dual diode blocks, 2 snubber boards, 1 gate driver board
Dynamic Braking IGBT — 208/230 V	ATV66D12M2, D16M2	VZ3IM1060M0601	
	ATV66D23M2	VZ3IM2075M0601	
	ATV66D33M2	VZ3IM2100M0601	
	ATV66D46M2	VZ3IM2150M0601	
Dynamic Braking Clamp Capacitor	ATV66C10N4 to C19N4	VY1ADC616	
	ATV66C23N41 to C31N41	VY1ADC614	
Line Filter Board — 460 V	ATV66D16N4, D23N4	VX4A66103	
	ATV66D33N4, D46N4	VX4A66104	
	ATV66D54N4 to D79N4	VX4A66105	
	ATV66C10N4 to C31N41	VX4A66106	
Line Filter Board — 208/230 V	ATV66D12M2, D16M2	VX4A66103	
	ATV66D23M2, D33M2	VX4A66104	
	ATV66D46M2	VX4A66105	
Line Rectifier Diode — 460 V	ATV66D16N4, D23N4	VZ3DM6075M1601	6-pack diode block
	ATV66D33N4	VZ3DM2080M1606	1 dual diode block
	ATV66D46N4	VZ3DM2100M1601	1 dual diode block
	ATV66D54N4 to D79N4	VZ3DM2160M1606	1 dual diode block
	ATV66C10N4, C13N4	VZ3DM2170M1602	1 dual diode block
	ATV66C15N4	VZ3DM2260M1602	1 dual diode block
	ATV66C19N4	VZ3DM2350M1602	1 dual diode block
	ATV66C23N41 to C31N41	VZ3DM2600M1602	1 dual diode block
Line Rectifier Diode — 208/230 V	ATV66D12M2, D16M2	VZ3DM6075M1601	6-pack diode block
	ATV66D23M2	VZ3DM2080M1606	1 dual diode block
	ATV66D33M2	VZ3DM2100M1601	1 dual diode block
	ATV66D46M2	VZ3DM2160M1606	1 dual diode block

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Spare Parts List (Continued)

Description	Drive Controller	Reference No.	Note
DC Bus Capacitor — 460 V	ATV66U41N4, U54N4	VY1ADC601	Assembly with capacitors
	ATV66U72N4	VY1ADC602	Assembly with capacitors
	ATV66U90N4	VY1ADC603	Assembly with capacitors
	ATV66D12N4	VY1ADC604	Assembly with capacitors
	ATV66D16N4, D23N4	VY1ADC152V450	One capacitor
	ATV66D33N4, D46N4	VY1ADC472V450	One capacitor
	ATV66D54N4	VY1ADC605	Assembly with capacitors and stirring fan
	ATV66D64N4, D79N4	VY1ADC606	Assembly with capacitors and stirring fan
	ATV66C10N4 to C19N4	VY1ADC615	Assembly with capacitors
	ATV66C23N41 to C28N41	VY1ADC608	Assembly with capacitors
DC Bus Capacitor — 208/230 V	ATV66U41M2	VY1ADC611	Assembly with capacitors
	ATV66U72M2	VY1ADC612	Assembly with capacitors
	ATV66U90M2	VY1ADC613	Assembly with capacitors
	ATV66D12M2, D16M2	VY1ADC152V450	One capacitor
	ATV66D23M2, D33M2	VY1ADC472V450	One capacitor
	ATV66D46M2	VY1ADC605	Assembly with capacitors and stirring fan
DC Bus Capacitor Bank Plexiglass Shield	ATV66C10N4 to C19N4	VY1ADV611	
Discharge Resistor — 460 V	ATV66D33N4 to D79N4	VZ3R5K0W040	One resistor
	ATV66C10N4 to C19N4	VZ3R2K5W600	Two resistors
	ATV66C23N41 to C31N41	VZ3R1K2W480	One resistor
Discharge Resistor — 208/230 V	ATV66D23M2 to D46M2	VZ3R5K0W040	One resistor
Precharge Resistor — 460 V	ATV66D16N4, D23N4	VZ3R033W009	One resistor
	ATV66D33N4, D46N4	VZ3R010W025	One resistor
	ATV66D54N4 to D79N4	VZ3R010W481	One resistor
	ATV66C10N4 to C31N41	VZ3R010W270	Two resistors
Precharge Resistor — 208/230 V	ATV66D12M2, D16M2	VZ3R033W009	One resistor
	ATV66D23M2, D33M2	VZ3R010W025	One resistor
	ATV66D46M2	VZ3R010W481	One resistor
Precharge Contactor — 460 V	ATV66D16N4, D23N4	LP4D1801BW3	
	ATV66D33N4	LC1D1801P7	
	ATV66D46N4	LC1D2501P7	
	ATV66D54N4, D64N4	LC1D4011P7	
	ATV66D79N4	LC1D6511P7	
	ATV66C10N4, C13N4	VY1A661C1010	
	ATV66C15N4, C19N4	VY1A661C1510	
	ATV66C23N41 to C31N41	VY1A661C2310	
Precharge Contactor — 208/230 V	ATV66D12M2, D16M2	LP4D2500BW3	
	ATV66D23M2	LC1D3201P7	
	ATV66D33M2	LC1D5011P7	
	ATV66D46M2	LC1D4011P7	
Precharge Contactor Auxiliary Contact Block	ATV66C10N4 to C31N41	LA1DN04	
Precharge Circuit Protector	ATV66C10N4 to C31N41	GV2M10	
Heatsink Fan — 460 V	ATV66U41N4, U54N4	VZ3V661	
	ATV66U72N4	VZ3V662	
	ATV66U90N4, D12N4	VZ3V663	
	ATV66D16N4, D23N4	VZ3V664	
	ATV66D33N4 to D79N4	VZ3V665	
	ATV66C10N4 to C19N4	VZ3V670	
	ATV66C23N41 to C31N41	VZ3V666	

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Spare Parts List (Continued)

Description	Drive Controller	Reference No.	Note
Heatsink Fan — 208/230 V	ATV66U41M2	VZ3V662	
	ATV66U72M2, U90M2	VZ3V663	
	ATV66D12M2, D16M2	VZ3V664	
	ATV66D23M2 to D46M2	VZ3V665	
Stirring Fan — 460 V	ATV66D33N4 to D79N4	VZ3V6654	Power board fan
	ATV66D54N4 to D79N4	VZ3V6655	Capacitor bank fan
	ATV66C10N4 to C19N4	VZ3V671	
	ATV66C23N41 to C31N41	VZ3V669	
Stirring Fan — 208/230 V	ATV66D23M2 to D46M2	VZ3V6654	Power board fan
	ATV66D46M2	VZ3V6655	Capacitor bank fan
Fan Failure Detection Assembly	ATV66C23N41 to C31N41	VY1ADR100	Resistor and temperature switch
Power Supply for Overtemperature Detection Circuit	ATV66C23N41 to C31N41	VY1A66200	
Heatsink Temperature Sensor	ATV66D16N4 to D79N4	VZ3GN006	
	ATV66C10N4 to C31N41	VZ3GN005	
	ATV66D12M2 to D46M2	VZ3GN006	
Temperature Switch	ATV66C10N4 to C19N4	VZ3G007	Switch mounted on fuse bar
	ATV66C10N4 to C19N4	VZ3G008	Switch mounted on heatsink and motor current sensor
	ATV66C23N41 to C31N41	VZ3G004	One 68C switch, one 85C switch, heatsink mounted
Motor Current Sensor — 460 V	ATV66D33N4, D46N4	VY1A66104	2 sensors
	ATV66D54N4 to D79N4	VY1A66105	2 sensors
	ATV66C10N4, C13N4	VY1A66106	
	ATV66C15N4, C19N4	VY1A66107	
	ATV66C23N41 to C31N41	VY1A66108	
Motor Current Sensor — 208/230 V	ATV66D23M2	VY1A66104	2 sensors
	ATV66D33M2, D46M2	VY1A66105	2 sensors
Ground Fault Sensor — 460 V	ATV66D16N4, D23N4	VY1A66114	
	ATV66D33N4, D46N4	VY1A66115	
	ATV66D54N4 to D79N4	VY1A66116	
	ATV66C10N4 to C19N4	VY1A66109	
	ATV66C23N41 to C31N41	VY1A66110	
Ground Fault Sensor — 208/230 V	ATV66D12M2, D16M2	VY1A66114	
	ATV66D23M2, D33M2	VY1A66115	
	ATV66D46M2	VY1A66116	
Control Power Transformer — 460 V	ATV66D33N4 to D79N4	VY1ADA604	
	ATV66C10N4 to C19N4	VY1ADA606	
	ATV66C23N41 to C31N41	VY1ADA607	
Control Power Transformer — 230 V	ATV66D23M2 to D46M2	VY1ADA614	
Control Power Fuses	ATV66C10N4 to C31N41	DF3CF00501	Two fuses
DC Bus Fuse	ATV66C10N4, C13N4	VY1ADF250V700	One fuse per kit
	ATV66C15N4, C19N4	VY1ADF350V700	
	ATV66C23N41 to C31N41	VY1ADF400V700	
AC Line Fuse	ATV66C23N41	VY1ALF700V700	One fuse per kit
	ATV66C28N41	VY1ALF800V700	
	ATV66C31N41	VY1ALF900V700	
Power Terminal Blocks — 460 V	ATV66D16N4, D23N4	VZ3N603	
	ATV66D33N4, D46N4	VZ3N604	
	ATV66D54N4 to D79N4	VZ3N605	
Power Terminal Blocks — 208/230 V	ATV66D12M2, D16M2	VZ3N603	
	ATV66D23M2, D33M2	VZ3N604	
	ATV66D46M2	VZ3N605	
Box Lug Power Terminal	ATV66C10N4 to C19N4	VZ3N008	C10 - C19 (L1-3, T1-3, +, -, GND) C15 - 19 (T1-3, +, -, GND)
Clam Shell Power Terminal	ATV66C10N4 to C19N4	VZ3N009	C15 - 19 (L1-3)
Power Terminal Plexiglass Shield	ATV66C10N4 to C19N4	VY1ADV612	

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Spare Parts List (Continued)

Description	Drive Controller	Reference No.	Note
Internal Power Cables — 460 V	ATV66D16N4, D23N4	VZ3N623	
	ATV66D33N4, D46N4	VZ3N624	
	ATV66D54N4 to D79N4	VZ3N625	
Internal Power Cables — 208/230 V	ATV66D12M2, D16M2	VZ3N627	
	ATV66D23M2, D33M2	VZ3N628	
	ATV66D46M2	VZ3N625	
Dynamic Braking Flexible Bus	ATV66C23N41 to C31N41	VZ3N626	Connects capacitor bank to PA terminal and DB IGBT module
Flex Cables — 460 V (Control Board J3, 4, and 5)	ATV66U41N4 to D12N4	VZ3N601	
	ATV66D16N4, D23N4	VZ3N613	
	ATV66D33N4 to D79N4	VZ3N615	
	ATV66C10N4 to C31N41	VZ3N616	
Flex Cables — 208/230 V (Control Board J3, 4, and 5)	ATV66U41M2 to U90M2	VZ3N601	
	ATV66D12M2, D16M2	VZ3N613	
	ATV66D23M2 to D46M2	VZ3N615	
Internal Hardware Kit — 460 V	ATV66U41N4 to U72N4	VY1ADV601	
	ATV66U90N4, D12N4	VY1ADV602	
	ATV66D16N4, D23N4	VY1ADV603	
	ATV66D33N4, D46N4	VY1ADV604	
	ATV66D54N4 to D79N4	VY1ADV605	
	ATV66C10N4 to C19N4	VY1ADV613	
	ATV66C23N41 to C31N41	VY1ADV614	
Internal Hardware Kit — 230 V	ATV66U41M2	VY1ADV601	
	ATV66U72M2, U90M2	VY1ADV602	
	ATV66D12M2, D16M2	VY1ADV603	
	ATV66D23M2, D33M2	VY1ADV604	
	ATV66D46M2	VY1ADV605	
Packaging Kits — 208/230/460 V (Order this kit if control basket is NOT mounted to a white metallic ground plane within the drive)	ATV66U41N4 to U72N4	VY1A66101	All plastic sides, covers and front door
	ATV66U90N4, D12N4	VY1A66102	
	ATV66D16N4, D23N4	VY1A66103	
	ATV66U41M2	VY1A66101	
	ATV66U72M2, U90M2	VY1A66102	
	ATV66D12M2, D16M2	VY1A66103	
Packaging Kits — 208/230/460 V (Order this kit if control basket is mounted to a white metallic ground plane within the drive)	ATV66U41N4 to U72N4	VY1A66111	All plastic sides, covers and front door
	ATV66U90N4, D12N4	VY1A66112	
	ATV66D16N4, D23N4	VY1A66113	
	ATV66U41M2	VY1A66111	
	ATV66U72M2, U90M2	VY1A66112	
	ATV66D12M2, D16M2	VY1A66113	
Clip Pliers (Tool for removing voltage regulator heatsink clips)	ATV66U41N4 to D23N4	VY1ADV608	Use when replacing power board, all IGBTs, filter board, precharge components, bus capacitors, diode bridge, temperature sensor, and ground fault sensor
	ATV66U41M2 to D16M2	VY1ADV608	

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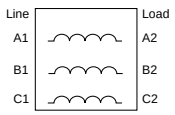
The ALTIVAR 66 AC Drives are designed to operate from industrial power systems with normal AC line conditions without the need of additional line impedance from either an isolation transformer or a line reactor. However, when abnormal line conditions exist, additional line impedance may be required. Typically, line reactors are used for:

- Minimize the input rms current to the AC drive ratings
- Lower the available fault current on high fault distribution systems
- Limit the total harmonic voltage distortion from the AC drive at the point of common coupling to align with IEEE 519 guidelines
- Prevent AC drive nuisance tripping due to transient overvoltages from power factor correction capacitor switching

HP Rating	208 V Line Reactor (separate mounted)	230 VAC Line Reactor (separate mounted)	460 VAC Line Reactor (separate mounted)
1	RL–00412	RL–00412	RL–00212
1.5	RL–00812	RL–00812	–
2	RL–00812	RL–00812	RL–00413
3	RL–01212	RL–01212	RL–00413
5	RL–01812	RL–01812	RL–00813
7.5	RL-02512	RL–02512	RL–01213
10	RL–03512	RL–03512	RL–01813
15	RL–04512	RL–04512	RL–02513
20	RL–05512	RL–05512	RL–03513
25	RL–08012	RL–08012	RL–03513
30	RL–10012	RL–08012	RL–04513
40	RL–13012	RL–10012	RL–05513
50	RL–16012	RL–13012	RL–08013
60	–	–	RL–08013
75	–	–	RL–10013
100	–	–	RL–13013
125	–	–	RL–16013
150	–	–	RL–20013
200	–	–	RL–25013
250	–	–	RL–32013
300	–	–	RL–40013
350	–	–	RL–50013
400	–	–	RL–50013



Line Reactors:

1. Part numbers are referenced and manufactured by MTE, Inc.
2. Harmonic compensated up to 150% of nominal current ratings
3. 5% nominal reactance
4. Offered in Type 1 general purpose enclosures
5. Intended for separate mounting and wired by the user.
6. Refer to the following publications on the subject of harmonics and benefits of drive isolation transformers:
   - — **8803PD9402–**Power Systems Harmonics–Cause and Effects of AC Drives.
   - — **7460HO9501**–Drive Isolation Transformers-Application, Selection and Specification Data
   - — **7460PD9501–** Drive Isolation Transformers–Solutions to Power Quality

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Low pass filters can be used on the output of the ALTIVAR 66 AC Drive to decease the stress of resonant frequencies on the attached motor. While low pass filters are not necessary for most installations, they do provide substantial benefits in installations involving long motor leads:

- 460 V or higher rated AC drives
- 1–25 HP rated units, if cable lead lengths are in excess of 75 feet
- 30–400 HP rated units, if cable lead lengths are in excess of 300 feet.
- Use of a non–inverter duty rated motor(s)
- Existing general purpose motors subject to retrofit to an AC drive

The motor protecting output filters combines inductance, capacitance and resistance to form a low pass filter. This filter will lower the dV/dt levels to prevent exciting the natural resonant wire frequency of the motor cables. Motors compliant to NEMA MG–1 Part 31 guidelines do not require the use of motor protecting output filters.

HP Rating @ 460 V	KLC Filter (separate mounting)
1–2	KLC4BE
3	KLC6BE
5	KLC8BE
7.5	KLC12BE
10	KLC16BE
15	KLC25BE
20–25	KLC35BE
30	KLC45BE
40	KLC55BE
50-60	KLC80BE
75	KLC110BE
100	KLC130BE
125	KLC160BE
150	KLC200BE
200	KLC250BE
250	KLC300BE
300	KLC360BE
350	KLC420BE
400	KLC480BE

Motor Protecting Output Filters:

1. Part number references are per Trans-Coil, Inc.
2. KLC filters are designed for cable lead lengths ranging from 50 to 1000 feet.
3. KLC filters include 1.5% nominal reactance at 480V
4. KLC filters are enclosed in Type 1 general purpose enclosures
5. KLC filters are intended for separate mounting and wiring by user

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Note:

These specifications are for adjustable frequency drive controllers or herein referred to as AC drives. The Construction Specifications Institute (CSI) format has been conformed with for project compatibility. Copies of this specification are available on IBM floppy disk or 100% IBM compatible formats as well as Macintosh configurations.

Application information directly affects the type and size of AC drive that will be quoted. Brackets are provided where such data should be included.

Please call your local Square D distributor or sales engineer for specification assistance regarding a particular application.

For better coordination, the AC drive specification should be included in Division 16 for Electrical Work.

PART 1: GENERAL

1.01
Scope of Work

a. This section provides specification requirements for AC inverter type adjustable frequency, variable speed drives or herein identified as AC drives for use with [NEMA B, NEMA A, NEMA C, NEMA E, synchronous] design, AC motors.

1.02
Quality Assurance

a. The AC drive and all options shall be UL listed according to Electric Industrial Control Equipment Specification UL 508C. A UL label shall be attached inside each enclosure as verification.
b. The AC drive shall be designed, constructed and tested in accordance with NEMA, NEC, VDE, IEC standards and CSA certified.
c. The manufacturer of the AC drive shall be a certified ISO 9002 facility.
d. The AC Drive manufacturer shall offer 24 hour a day product and application response via a nationwide network of factory certified technical support personnel.

1.03
Warranty

a. A manufacturers warranty shall be provided on all materials and work-manship of no less than 1 year from the date of start-up or 18 months from date of shipment.

PART 2: PRODUCTS

2.01
Acceptable Manufacturers

a. The AC drive shall be an ALTIVAR 66 supplied by the Schneider North America/Square D Company or prior approved equal, no substitutions are permitted.
b. Alternate control techniques other than pulse width modulated technology (PWM), are not acceptable.

2.02
General Description

a. The AC drive shall convert the input AC mains power to an adjustable frequency and voltage as defined in the following sections.
b. The rectifier stage shall convert fixed voltage, fixed frequency, AC line power to fixed DC voltage. The input power section shall utilize a full wave bridge design incorporating diode rectifiers. The rectifier shall be insensitive to phase rotation of the AC line. The DC voltage shall be filtered.
c. The DC bus shall offer external connections for standby battery back-up or for linking multiple, AC drive buses.
d. The inverter shall change fixed DC voltage to variable frequency AC. The inverter section shall utilize insulated gate bipolar transistors (IGBTs) or intelligent power modules (IPMs) as required by the current rating of the motor.

2.03
Motor Data

a. The AC drive shall be sized to operate a [NEMA design B] AC motor with a nameplate rating as defined in the National Electric Code, table 430-149, for the applicable horsepower.
b. The service factor of the motor is 1.15 at the rated voltage and frequency.

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2.04
Application Data

a. The AC drive shall operate a [variable torque load, constant torque load, constant horsepower load, impact load].
b. The speed range shall be from a minimum speed of 0.5 Hz @ 100% breakaway torque to a maximum speed of 200 Hz.

2.05
Environmental Ratings

a. A.The AC drive construction shall be of Type 1 listed enclosure that allows operation in a Pollution Degree 3 environment shall meet NEMA Type 1/IP30 or NEMA Open/IP20. The AC drive will meet IEC 664-1 and NEMA ICS 1-111A Part 3 standards. AC drives that are only rated for Pollution Degree 2 environment will not be allowed.
b. The AC drive will be designed to operate in an ambient temperature from 0° to +40 °C (+32° to +104 °F).
c. The storage temperature range shall be -25° to +70 °C.
d. The maximum relative humidity shall be 95% at 40 °C, non-condensing.
e. The AC drive will be rated to operate at altitudes less than or equal to 1000 m (3,300 ft.). For altitudes above 1000 m, derate the AC drive by 1.2% for every 100 m (330 ft.).
f. The AC drive will meet the IEC 68-2-6 vibration specification.
g. AC drives 75 hp and smaller will be designed and constructed to be of finger safe construction with the enclosure open to operator access according to I P20 standards.

2.06
Ratings

a. The AC drive shall be designed to operate from an input voltage of 400±15% Vac and 460±15% Vac.
b. The AC drive shall operate from an input voltage frequency range from 47.5 to 63 Hz.
c. The displacement power factor shall not be less than 0.95 lagging under any speed or load condition.
d. The efficiency of the AC drive at 100% speed and load shall not be less than 96%.
e. The constant torque overtorque capacity will be 150% for 1 minute [The variable torque overtorque capacity will be 110% for 1 minute].
f. The output carrier frequency of the drive will be randomly modulated and selectable at 2 kHz, 4 kHz or 10 kHz depending on drive rating for low noise operation. No AC drives with an operable, carrier frequency above 10 kHz will be allowed.
g. The output frequency shall be from 0.1 to 400 Hz for AC drives up to 75 hp. At horsepowers above 75 hp, the maximum output frequency will be 200 Hz.
h. The AC drive will be able to provide rated motor torque at 0.5 Hz in a Sensorless Flux Vector mode using a standard motor and no tachometer feedback.

2.07
Protection

a. The AC drive design and all hardware options will meet IP20 standards and allow for finger safe access with the front cover open for all AC drives through 75 hp.
b. Upon power-up the AC drive shall automatically test for valid operation of memory, option module, loss of analog reference input, loss of communication, dynamic brake failure, DC to DC power supply, control power, and the pre-charge circuit.
c. The AC drive shall be protected against short circuits between output phases; between output phases and ground; on the outputs; on the internal supplies; and on the logic and analog outputs.
d. The AC drive shall have a minimum of power loss ride-through of 200 msec. The AC Drive shall have the user defined option of frequency fold-back to increase the duration of the powerloss ride-through.
e. The AC drive will have a selectable ride through function which will allow the logic to maintain control for a minimum of one second without faulting.
f. For a fault condition other than a ground fault, short circuit or internal fault, an auto restart function will provide up to 5 programmable restart attempts. The programmable time delay before restart attempts will range from 1 second to 600 seconds.
g. The deceleration mode of the AC drive shall be programmable for normal and fault conditions. The stop modes shall include free-wheel stop, fast stop and DC injection braking.
h. A synchronized restart shall be provided that will catch a spinning motor by sensing the motor frequency and rotational direction and synchronize the AC drive's output prior to restarting.

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i. Upon loss of the analog process follower reference signal, the AC drive shall fault and/or operate at a user defined speed set between software programmed low speed and high speed settings.

j. The AC drive shall have solid state I^2t protection that is UL listed and meets UL 508 C as a Class 10 overload protection and meets IEC 947. The adjustment shall be from 0.45 to 1.05 percent of the current output of the AC Drive.

k. The AC Drive shall have a thermal switch with a user selectable prealarm that will provide a minimum of 60 seconds delay before overtemperature fault.

l. The AC Drive shall utilize bonded fin heatsink construction for maximum heat transfer.

m. The AC drive shall have a programmable fold-back function that will anticipate drive overload condition and fold back the frequency to avoid a fault condition.

n. The output frequency shall be software enabled to fold back when the motor is overloaded.

o. There shall be 3 skip frequency ranges that can each be programmed with a selectable bandwidth of 2 or 5 Hz. The skip frequencies shall be programmed independently, back to back or overlapping.

2.08
Adjustments and Configurations

a. The AC drive will self-configure to the main operating supply voltage and frequency. No operator adjustments will be required.

b. Upon power-up, the AC drive will automatically send a signal to the connected motor and store the resulting resistance data into memory. The inductance data will be measured during no-load operation when operating at a frequency between 20-60 Hz. The AC Drive will automatically optimize the operating characteristics according to the stored data.

c. The AC drive will be factory pre-set to operate most common applications.

d. A choice of three types of acceleration and deceleration ramps will be available in the AC Drive software: linear, S curve and U curve.

e. The acceleration and deceleration ramp times shall be adjustable from 0.1 to 999.9 seconds.

f. The volts per frequency ratios shall be user selectable to meet quadratic torque loads, normal and high torque machine applications.

g. The memory shall retain and record run status and fault type of the past 8 faults.

h. Slip compensation shall be a software enabled function.

i. The software shall have a NOLD (no load) function that will reduce the voltage to the motor when selected for variable torque loads. A constant volts/Hz ratio will be maintained during acceleration. The output voltage will then automatically adjust to meet the torque requirement of the load.

j. The AC drive shall offer programmable DC injection braking that will brake the AC motor by injecting DC current and creating a stationary magnetic pole in the stator. The level of current will be adjustable between 50-150% of rated current and available from 0.0-30 seconds continuously. For continuous operation after 30 seconds, the current shall be automatically reduced to 50% of the nameplate current of the motor.

k. Sequencing logic will coordinate the engage and release thresholds and time delays for the sequencing of the AC drive output, mechanical actuation and DC injection braking in order to accomplish smooth starting and stopping of a mechanical process.

2.09
Operator Interface

a. The operator interface terminal will offer the modification of AC drive adjustments via a touch keypad. All electrical values, configuration parameters, I/O assignments, parameter adjustments, application and activity function access, faults, local control, adjustment storage, self-test and diagnostics will be in plain English. There will be a standard selection of 5 additional languages built-in to the operating software as standard.

b. The display will be a high resolution, LCD backlighted screen capable of displaying graphics such as bar graphs as well as six lines of twenty-one alphanumeric characters.

c. The AC drive model number, torque type, software revision number, horsepower, output current, motor frequency and motor voltage shall all be listed on the drive identification display as viewed on the LCD display.

d. The display shall be configured to display one or two bargraphs with numeric data that are selectable and scalable by the operator. A user defined label function shall be available. As a minimum the selectable outputs shall consist of speed reference, output frequency, output current, motor torque, output power,

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output voltage, line voltage, DC voltage, motor thermal state, drive thermal state, elapsed time, motor speed, machine speed reference and machine speed.

e. A single keystroke scrolling function shall allow dynamic switching between display variables.

f. The terminal keypad will consist of programmable function keys. The functions will allow both operating commands and programming options to be preset by the operator. A hardware selector switch will allow the terminal keypad to be locked out from unauthorized personnel.

g. The operator terminal will offer a general menu consisting of parameter setting, I/O map, fault history, and drive configuration. A software lock will limit access to the main menu. The main menu will consist of keypad configuration, drive configuration, general configuration, diagnostic mode and drive initialization screens.

h. There will be arrow keys that will provide the ability to scroll through menus and screens, select or activate functions or increase the value of a selected parameter.

i. A data entry key will allow the user to confirm a selected menu, numeric value or allow selection between multiple choices.

j. An escape key will allow a parameter to return the existing value if adjustment is not required and the value is displayed. The escape function will also return to a previous menu display.

k. A RUN key and a STOP key will command a normal starting and stopping as programmed when the AC drive is in keypad control mode. These keys will be shipped with a cover in the event that control logic requires that these commands be located away from the main drive cabinet.

l. The AC drive shall have 3 LEDs mounted on the front panel to indicate functional status. A green LED will verify that the AC drive power supply is on. A red LED indicator will indicate an AC drive fault. A yellow LED indicator will designate a pending fault condition.

m. The status LEDs shall be able to be remotely mounted up to 3 meters from the AC drive.

n. A user interface shall be available that is a Windows® 3.1 based personal computer, serial communication link or detachable operator interface.

2.10
CONTROL

a. External pilot devices shall be able to be connected to a terminal strip for starting/stopping the AC Drive, speed control and displaying operating status. All control inputs and outputs will be software assignable.

b. 2-wire or 3-wire control strategy shall be defined within the software. External relays or logic devices will not be allowed.

c. The control power for the digital inputs and outputs shall be [24 Vdc or 115 Vac].

d. The internal power supply incorporates an automatic current fold-back that protects the internal power supply if incorrectly connected or shorted. The transistor logic outputs will be current limited and not be damaged if shorted or excess current is pulled.

e. All logic connections shall be furnished on pull apart terminal strips.

f. There will be 2 software assignable, analog inputs. The analog inputs will be software selectable and consist of the following configurations: 0-20 ma, 4-20 ma, 20-4 ma, x-20 ma (where x is user defined) 0-5 V, 1-5 V or 0-10 V.

g. There will be 4 software assignable, isolated logic inputs that will be are selected and assigned in the software. The selection of assignments shall consist of run/reverse, jog, plus/minus speed (2 inputs required), setpoint memory, preset speeds (up to 2 inputs), auto/manual control, controlled stop, terminal or keypad control, by-pass (2 inputs required), motor switching, and fault reset.

h. There will be two software assignable analog outputs that can be selected and assigned in the software. The analog output assignments shall be proportional to the following motor characteristics: frequency, current, power, torque, voltage and thermal state. The output signal will be selectable from 0-20 ma or 4-20 ma.

i. Two voltage-free Form C relay output contacts will be provided. One of the contacts will indicate AC drive fault status. The other contact will be user assignable.

j. There shall be a hardware input/output extension module which also provides interlocking and sequencing capabilities. The module shall be fully isolated and housed in a finger safe enclosure with pull apart terminal strips. The module will add 4 logic inputs, 2 analog inputs, 2 relay outputs and one analog output. All of the I/O will be user assignable in the software as previously defined.

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2.11
Braking
(Application Dependent Option)

Note:

When braking certain types of loads, there is the conversion of kinematic energy into electrical energy by the motor which is returned to the AC drive.

Dynamic braking can be chosen to absorb this energy and avoid causing the AC drive to inadvertently shut down. The energy is dissipated across a resistor that is connected to the drive. For constant torque AC drives, the dynamic braking unit must be capable of stopping 1.5 per unit motor torque from base frequency to 0.5 Hz with sensorless flux vector control mode.

a. The dynamic brake resistor shall be provided and connect to existing terminals on the AC drive. The resistor shall mount externally to the AC drive enclosure. A power transistor will be provided in the AC drive to switch the excess energy to the braking resistor. The braking resistor will be of a size calculated to stop 6 times motor inertia at 1.5 per unit motor torque.

2.12
HARMONIC ANALYSIS

Note:

The amount of harmonic distortion at the point of common coupling (PCC) is due to the distribution system characteristics (impedance of the source) and the power source size relative to the AC drive load. The harmonic current magnitude and voltage distortion values can be predicted through computer modeling. If the resulting calculations determine that the harmonic distortion will be above the IEEE-519 specifications of 5%, isolation transformers or line reactors can be supplied to lower the harmonic levels. The isolation transformers or line reactors are mounted at the AC drive input to reduce the current harmonics that are fed back into the supply.

a. A harmonic analysis shall be performed and priced as a separate line item by the AC drive manufacturer based upon system documentation consisting of but not limited to one-line diagrams and specific distribution transformer information consisting of X/R, %Z, and kva data. The data shall consist of but not be limited to total harmonic voltage distortion and total rms current.
b. The maximum allowable input line unbalance shall be [5% for 460 V input line short circuit capacity of 15,000 amps] [2.5% for 460 V input line short circuit capacity of 30,000 amps] [.5% for 460 V input line short circuit capacity of 65,000 amps]. If the resulting voltage harmonic distortion exceeds 5%, three phase, line reactor(s) shall be priced as a separate line item.
c. The line reactor(s) if required shall be provided in stand-alone Type 1 enclosures for mounting separately from the AC drive.

PART 3: EXECUTION

3.01
Inspection

a. Verify that the location is ready to receive work and the dimensions are as indicated.
b. Verify that power is available to the AC drives prior to installation.

3.02
Protection

a. Before and during the installation, the AC drive equipment shall be protected from site contaminants.

3.03
Installation

a. Installation shall be in compliance with manufacturer's instructions, drawings and recommendations.
b. The AC drive manufacturer shall provide a factory certified technical representative to supervise the contractor's installation, testing and start-up of the AC drive(s) furnished under this specification for a maximum total of [ ] days. The start-up service shall be quoted as a separate line item.

3.04
Training

a. An on-site training course of [ ] training days shall be provided by a representative of the AC drive manufacturer and quoted as a separate line item.

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Support

Product Support Group – Troubleshooting

The Product Support Group is available 24 hours a day, 365 days a year. They will work with you over the phone to diagnose product problems and advise the correct course of action.

Phone: 919-217-6535 press “3”

Fax: 919-217-6508

E-mail: drivespsg.raleigh@squared.com

D-FAX Fax-On-Demand Service

The D-FAX™ service from Square D provides immediate access to information. The automated voice attendant will guide you through the process and you will receive the information on your fax machine within minutes. Please refer to the D-FAX reference numbers in the catalog.

Phone: 800-557-4556

Square D Field Service

The Square D Field Services division is committed to providing quality on-site service that consistently meets customer expectations. The Field Services Coordination Center responds to your requests, seven days a week, 24 hours a day.

Phone: 800-634-2003

Literature Fulfillment Center

To obtain support literature for your product or application needs, contact the Square D Literature Fulfillment Center.

Phone: 800-392-8781

Fax: 800-824-7151

Square D Product Training

Square D offers a variety of instructor-led skill enhancing and technical product training programs, as well as self-paced product training programs. For a complete list of drives/soft start training with dates and locations please call:

Phone: 847-925-3700

Fax: 847-925-7816

Square D Website

Visit the virtual work zone at the Square D website. It offers a variety of solutions for your drive and soft start applications. It also includes software tools, new product information, and product selection information.

Web Address: http://www.squared.com

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Drives

Class 8839 – ALTIVAR 66 Enclosed

The Class 8839 Enclosed ALTIVAR 66 packages are comprised of 13 separate power circuit designs incorporated into integrated, optimized, and barriered enclosures (Type 1 and Type 12). These Bypass Isolation and Combination power circuits have been tested and rated for up to 65,000 AIC withstand capability.

Catalog # 8800CT9701
Brochure # 8839BR9501
D-Fax # 18

Catalog # 8800CT9701
Brochure # 8803HO9401R11/96
D-Fax # 18

ALTIVAR 66

The ALTIVAR 66 uses Sensorless Vector Control, a modular design and an extensive range of options to satisfy the needs of industrial, construction, and OEM applications.

- 1 - 350 hp 460 V (400 hp VT)
- 1 - 40 hp 208 V/230 V (50 hp VT)

Class 8839 – ALTIVAR 56 "BELE Box"

The ALTIVAR 56 is also available in a Class 8839 combination package mounted on a back panel with a Type 1 "BELE" Box beneath the drive. There are 3 different configurations:

- Combo package
- Bypass package
- Remote Starter Bypass package

Catalog # 8839RL9701
Brochure # 8839CT9601
D-Fax # 18

Catalog # 8839RL9701
Brochure # 8800HO9601
D-Fax # 18

ALTIVAR 56

The ALTIVAR 56 is based on our popular ALTIVAR 66 drive and is designed specifically for Fan and Pump applications.

- 1 - 100 hp 460 V
- 1 - 50 hp 208 V/230 V

Class 8998 – ALTIVAR 66 and 56 in Motor Control Centers

The Class 8998 Motor Control Center drives incorporate ALTIVAR 66 and 56 drives in units fully compatible with Square D Model 5 or 6 MCCs. Type 1, Type 1A (gasketed), and Type 12 MCC drives are available. The efficient thermal management design of this product provides the industry's smallest space requirements and high reliability. All units are rated for a high fault withstand rating of 65,000 A @ 480 Vac and are UL Listed in full compliance with UL 845 standards. A wide range of factory options for controls and contactor circuits are offered.

- 1 - 400 hp @ 480 V

Catalog # 8998CT9701
Brochure # 8998BR9701
D-Fax # 08

Catalog # 8802CT9301R2/96
Brochure # 8802BR9203
D-Fax # 18

ALTIVAR 16

The ALTIVAR 16 uses application specific and communication option modules to address OEM and industrial drive challenges. Its compact design and ease of operation make it an excellent choice for low horsepower drive applications.

- 1 - 5 hp 460 V
- 0.5 - 3 hp 230 V

Catalog #8805CT9701
Brochure # 8805HO9701
D-Fax # 18

ALTIVAR 18

The ALTIVAR 18 is an open loop vector drive that offers a compact design and flexible capabilities to meet a wide variety of applications. It has built in filters to meet the low voltage and EMC directives for CE marking.

- 1 - 20 hp 460 V
- 0.5 - 10 hp 208 V/230 V

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Soft Starts

ALTISTART® 46

The ALTISTART 46 soft start introduces the principal of "Torque Control System" (TCS) ramping. Basing the acceleration on the motor rather than applying a voltage ramp or maintaining a current limit (as used in traditional soft starts) provides a linear speed ramp – independent of motor loading – without tach feedback.

There are 21 power ratings from 17 to 1200 A
Each can be configured for 208/230/380/460 V, 50/60 Hz.

Catalog # 8636CT9701
Brochure # 8636HO9701
D-Fax # 23

Class 8636 – ALTISTART 46 Non-Combination Enclosed
Class 8638 – ALTISTART 46 Combination Enclosed Fusible
Class 8639 – ALTISTART 46 Combination Enclosed Circuit Breaker

A family of enclosed soft start controllers are available through 500 hp for easy integration of the ALTISTART 46 into industrial facilities. The Class 8638 and 8639 combination style soft starts combine the requirements of motor overload and short circuit protection in a Type 12 enclosure, and are available for reversing and non-reversing applications.

Catalog # 8636CT9701
D-Fax # 23

Electromechanical Reduced Voltage Starters
Class 8606 – Autotransformer Starter
Class 8630 – Wye Delta Starter
Class 8640 – Part Winding Starter

Square D offers a full line of Electromechanical Reduced Voltage Starter products to minimize the electrical and mechanical stresses caused by across the line starting.

Catalog # 8600CT9601
D-Fax # 23

LH4N

The LH4N soft starter module allows gradual starting and stopping of single and three phase motors. Unlike conventional electromechanical starting systems, the LH4N provides precise adjustment of the motor torque which eliminates mechanical shocks. The LH4N is designed for installation downstream from a motor starter circuit which includes a power contactor and approved motor overload and short circuit protection.

- 6 A to 25 A –208/240/380/460 V

Catalog # 8637CT9701
Brochure # 8637HO9701
D-Fax # 23

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Warranty

Warranty to customers purchasing through authorized Square D distributors and customers purchasing directly from Square D.

Square D warrants equipment manufactured by it to be free from defects in materials and workmanship for eighteen months from date of invoice from Square D or its authorized sales channel. If within the applicable warranty period purchaser discovers such item was not warranted and promptly notifies Square D in writing, Square D shall repair or replace the items or refund the purchase price, at Square D's option. This warranty shall not apply (a) to equipment not manufactured by Square D, (b) to equipment which shall have been repaired or altered by others than Square D, (c) to equipment which shall have been subjected to negligence, accident, or damage by circumstances beyond Square D's control, or to improper operation, maintenance or storage, or to other than normal use or service. With respect to equipment sold but not manufactured by Square D, the warranty obligations of Square D shall in all respects conform and be limited to the warranty actually extended to Square D by its supplier. **The foregoing warranties do not cover reimbursement for labor, transportation, removal, installation, or other expenses which may be incurred in connection with repair or replacement.**

Except as may be expressly provided in an authorized writing by Square D, Square D shall not be subject to any other obligations or liabilities whatsoever with respect to equipment manufactured by Square D or services rendered by Square D.

The foregoing warranties are exclusive and in lieu of all other express and implied warranties except warranties of title, including but not limited to implied warranties of merchantability and fitness for a particular purpose.

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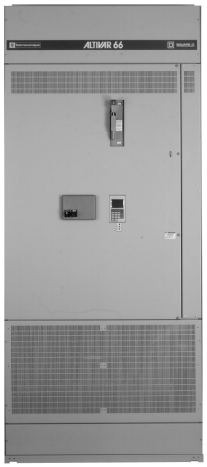

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INTRODUCTION

The Class 8839 ALTIVAR AC drive is for adjustable speed operation of standard AC squirrel cage motors. These AC Drives may be selected for constant or variable torque type loads and are enclosed in Type 1 or Type 12 wall or floor mounted enclosures. This is a sensorless flux vector based AC drive with Insulated Gate Bipolar Transistors (IGBT) and keypad as standard, that may be programmed to configure the drive's performance for wide variety of applications.

ALTIVAR 66 HP Ratings

1-400 hp, 460 Vac

1-50 hp, 208/230 Vac

This Class 8839 AC drive has been designed to offer Build To Order capabilities for the user to match individual application requirements. Specific power and control circuit modifications may be selected from this catalog by the user to customize an AC drive for his specific application. These modifications are pre-engineered to satisfy the most demanding delivery requirements.

Also offered in this catalog are engineered features that allows the user to further customize an AC drive beyond the standard modifications listed. This will provide the maximum flexibility for a user to select an Build To Order AC drive for nearly any AC squirrel cage motor application requiring adjustable speed operation.

ENCLOSURE TYPES

There are three enclosure designs that may be selected to meet Type 1 & 12 specifications. Enclosure designs are dependent on the Power Circuit Type selected.

Optimized

Provides the most compact mounting space for the ALTIVAR 66 with a disconnect device. Also for configurations without a disconnect device or bypass contactors.

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Integrated

Provides the best utilization of mounting space when combining the ALTIVAR 66 with power peripherals, such as line contactors, isolation & bypass contactors within the same enclosure.

Barriered

Provides a compartmentalized AC drive and bypass solution by separating isolation and bypass contactors for the AC drive in separate compartments. This provides ultimate physical isolation between the two separate motor controllers.

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Class 8839 Enclosed AC Drives
Drive Selection

The Class 8839 ALTIVAR 66 enclosed AC drives are designed for flexibility to meet applications requiring additional enclosure space for features such as line disconnects, meters, pilot devices, or isolation and bypass contactors. To select an AC drive, identify the catalog number by **Class, Type and Modification number(s)** as shown below.

Class **Type Number** **Modifications**

8839	66U											
	❶	❷	❸	❹	❺	❻	❼					

❶ Product

Code	Enclosed Drive
66U	ALTIVAR 66

❷ Horsepower

Code	HP rating @ 208/230V 460V	Code	HP rating @ 460V
C	1 hp	**Q**	60 hp
D	2 hp	**R**	75 hp
E	3 hp	**S**	100 hp
F	5 hp	**T**	125 hp
G	7.5 hp	**U**	150 hp
H	10 hp	**W**	200 hp
J	15 hp	**X**	250 hp
K	20 hp	**Y**	300 hp
L	25 hp	**Z**	350 hp
M	30 hp	**4**	400 hp
N	40 hp		
P	50 hp		

❸ Enclosure Type

Code	Environment rating
G	Type 1
A	Type 12

❹ Voltage Rating

Code	Utilization/ Distribution
2	200/208 VAC
3	230/240 VAC
4	460/480 VAC

❻ Power Circuit Description

Code	with Bypass	Code	without Bypass
C	Single Disconnect Integrated 2-contactors 22,000 AIC rating	**A**	No Disconnect Optimized enclosure 65,000 AIC rating
D	Single Disconnect Integrated 2-contactors 65,000 AIC rating	**B**	Disconnect Optimized enclosure 65,000 AIC rating
E	Dual Disconnects Barriered 2-contactors 22,000 AIC rating	**G**	Output contactor Integrated enclosure 65,000 AIC rating
F	Dual Disconnects Barriered 2-contactors 22,000 AIC rating	**H**	Line contactor Integrated enclosure 65,000 AIC rating
I	Isolation & transfer Integrated 2-contactors 65k,000 AIC rating		
J	Single Disconnect Integrated 3-contactors 22,000 AIC rating		
K	Single Disconnect Integrated 3-contactors 65,000 AIC rating		

❺ Application Type

Code	Applied rating
C	Constant Torque
V	Variable Torque
L	Low Noise Variable Torque (1- 75 hp @ 460 V)

Standard AC Drive Includes:

- Disconnect device with flange-mounted external operator interlocked with the door (except when Power Circuit A is selected)
- Sensorless Flux Vector Technology
- Insulated Gate Bipolar Transistor (IGBT) with PWM output waveform
- 200,000 AIC current limiting line fuses installed
- Door mounted Keypad display with lock out capability
- Door mounted status lights; red fault LED, yellow caution LED and green drive ready LED
- Dry contacts for drive run and drive fail indication
- UL 508C listed with NEMA ICS 7.1 compliance
- Type 1 or 12 enclosure

Factory Modifications Include:

- Door mounted pilot devices and meters
- I/O extension module
- Line contactors
- Output contactors
- Isolation/bypass
- Factory engineered features

Engineered Specials “Build to Order”:

- Can also accommodate ‘job specific’ engineered specials; consult the Drives Applications Group for details.

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These factory modifications offer maximum flexibility for the Class 8839 ALTIVAR 66 Enclosed AC Drives to meet many complex job specifications.

The listing below defines all the available factory modifications. All modifications follow specific interoperability rules for selection. Modification selection can be validated at time of quotation or order entry by the Square D Quote to Cash Product Selector.

❼ Modifications			
Mod	*Door mounted meter (1st selection)*	*Mod*	*Miscellaneous devices*
A07	Analog percent speed	**A16**	Red 'Power On' pilot light
B07	Analog percent current	**B16**	Yellow 'Fault' pilot light
C07	Analog percent volts	**C16**	Green 'Jog' pilot light
D07	Analog percent power	**D16**	Green 'Run' pilot light
E07	Digital ammeter (amperes)	**E16**	Yellow 'Hand & Auto' pilot lights
F07	Digital voltmeter (voltage)	**F16**	Green 'Forward & Reverse' pilot lights
G07	Digital speed meter (frequency)	**G16**	Yellow 'Fault' pilot light & reset pushbutton
H07	Digital power meter (kilowatts)	**H16**	Bypass 3 Wire control
J07	Digital percent current	**J16**	Bypass Duty Cycle Timer
K07	Digital percent volts	**K16**	Automatic transfer to Bypass
L07	Digital percent speed	**L16**	Additional Control VA capacity
M07	Digital percent power	**O16**	Oversized Enclosure (Size 5 only)
Door mounted meter (2nd selection)		**P16**	Automatic Start Relay (remote control voltage source)
A08	Analog percent speed	**Q16**	3-15 psi input follower
B08	Analog percent current	**R16**	Convert to Push-to-Test pilot devices
C08	Analog percent volts	**S16**	24VDC Power Supply
D08	Analog percent power	**T16**	Motor Elapsed Time Meter
E08	Digital ammeter (amperes)	**W16**	Fast Stop pushbutton
F08	Digital voltmeter (voltage)	**Y16**	Omit Door Mounted Keypad
G08	Digital speed meter (frequency)		
H08	Digital power meter (kilowatts)		
J08	Digital percent current		
K08	Digital percent volts		
L08	Digital percent speed	*Factory Engineered features*	
M08	Digital percent power	**Q200**	Auxiliary drive run contacts
General Purpose pilot devices		**Q201**	Auxiliary bypass run contacts
A09	Start & Stop pushbuttons	**Q202**	Auxiliary drive fail contacts
B09	Start & Stop pushbuttons and speed pot	**Q203**	Auxiliary auto mode contacts
C09	Start & Stop pushbuttons and Hand/Auto switch	**Q204**	Motor space heater
D09	Start & Stop, Hand/Auto switch and speed pot	**Q205**	Signal loss follower option board
E09	Stop, Forward and Reverse pushbuttons	**Q206**	Emergency power off pushbutton
F09	Stop, Forward and Reverse pushbuttons & speed pot	**Q207**	Inhibit/shutdown sequence (instantaneous operation)
G09	Stop-Run switch	**Q208**	Inhibit/shutdown sequence (timed operation)
H09	Stop-Run switch and speed pot	**Q209**	Check valve sequence (gravity type)
J09	Forward-Off-Reverse switch	**Q210**	Check valve sequence (motorized type)
K09	Forward-Off-Reverse switch and speed pot	**Q211**	Seal water solenoid - without pressure switch feedback
L09	Hand-Off-Auto switch	**Q212**	Seal water solenoid - with pressure switch feedback
M09	Hand-Off-Auto switch and speed pot	**Q213**	Moisture detection relay circuit (without relay)
Special Purpose pilot devices		**Q214**	Moisture detection relay circuit (with relay)
A10	Run-Jog switch	**Q300**	ID engraved nameplates
C10	Jog pushbutton	**Q301**	Permanent wire markers
D10	Jog Forward and Jog Reverse pushbuttons	**Q302**	Fan filter assembly
F10	Forward-Reverse switch	**Q303**	ANSI# 49 enclosure paint
Option Board		**Q304**	ANSI# 61 enclosure paint
A11	24VDC I/O extension board	**Q400**	Top mounted 5% line reactor
Dynamic Braking		**Q401**	Top mounted motor protecting filter
D15	Dynamic braking resistors (top mounted)	**Q402**	NEMA rated contactors

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POWER CIRCUITS

There are eleven Power Circuit configurations: six configurations that provide isolation/bypass capability and five non-bypass types.

Isolation/bypass contactors provide emergency full speed operation with Class 10 overloads. The circuit schemes consist of 2 and 3 contactors with 2 levels of short circuit ratings. The two contactor schemes are available with single disconnect or dual disconnects.

The short circuit current rating should be coordinated with the available short circuit current from connected power distribution.

Isolation/Bypass Contactors

2 - Contactor Isolation/Bypass	3 - Contactor Isolation/Bypass
Two contactor Isolation/Bypass configurations sequence the contactors to provide true isolation of the motor when it is not running. Both mechanical and electrical interlocks eliminate the possibility of back feeding the AC drive with incoming power. Auxiliary contact from the isolation contactor provides positive indication that the motor is connected to the AC drive before beginning a run command. Time delays allow the residual voltage to decay when transferring from drive control to bypass thereby reducing the possibility of nuisance drive or circuit breaker tripping.	Three contactor Isolation/Bypass configurations provide the same functions as Two contactor Isolation/Bypass but use a line contactor to remove line power form the AC drive. These configurations use momentary POWER ENABLE and POWER DISABLE push-buttons to control operation of the line contactor. Operation of the line contactor is a 3-wire control strategy which requires operator intervention to re-apply power after a power interruption. **Three contactor Isolation/Bypass do not allow for automatic restart capability.** The line contactor provides isolation of L1, L2, L3 with control power remaining for using Auto-Diagnostics.

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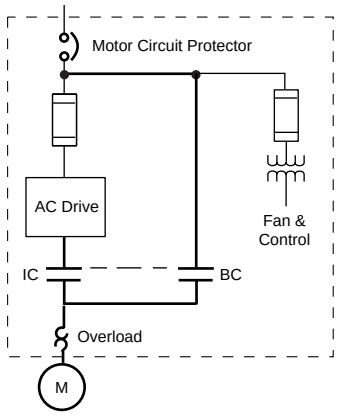
ISOLATION AND BYPASS SCHEMES

2-Contactor Isolation/Bypass with Single Disconnect



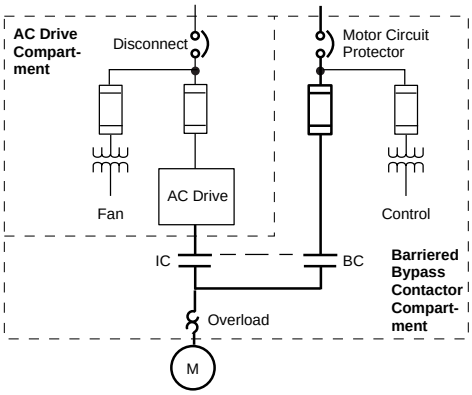
Code C

Standard Iso/bypass features:

- IEC contactors with Class 10 overloads
- 22k AIC short circuit rating
- AFC (green lens) and BYPASS (amber lens) pilot lights door mounted on bypass control island
- AFC-OFF-BYPASS selector switch door mounted on bypass control island

Available with 1-200 hp AC drives only

2-Contactor Isolation/Bypass with Dual Disconnect

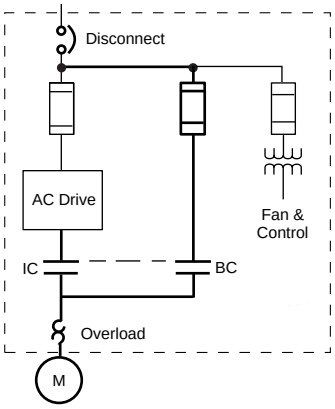


Code E

Standard Iso/bypass features:

- IEC contactors with Class 10 overloads (1-200 hp)
- NEMA contactors with Class 20 overloads (250-400 hp)
- 22k AIC short circuit rating
- AFC (green lens) and BYPASS (amber lens) pilot lights door mounted on bypass control island
- AFC-OFF-BYPASS selector switch door mounted on bypass control island

Available with 1-400 hp AC drives only

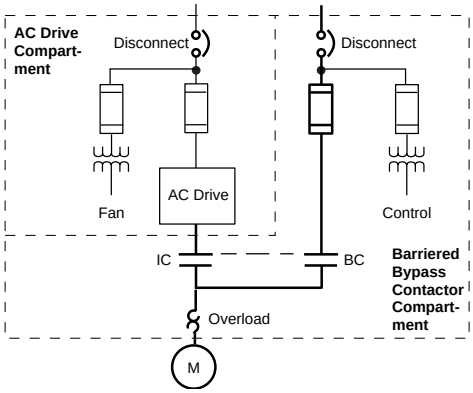


Code D

Standard Iso/bypass features:

- IEC contactors with Class 10 overloads
- 65k AIC short circuit rating
- Bypass fuse not included. Class J or RK-1 required
- AFC (green lens) and BYPASS (amber lens) pilot lights door mounted on bypass control island
- AFC-OFF-BYPASS selector switch door mounted on bypass control island

Available with 1-200 hp AC drives only



Code F

Standard Iso/bypass features:

- IEC contactors with Class 10 overloads (1-200 hp)
- NEMA contactors with Class 20 overloads (250-400 hp)
- 65k AIC short circuit rating
- Bypass fuse not included. Class or RK-1 required
- AFC (green lens) and BYPASS (amber lens) pilot lights door mounted on bypass control island
- AFC-OFF-BYPASS selector switch door mounted on bypass control island

Available with 1-400 hp AC drives only

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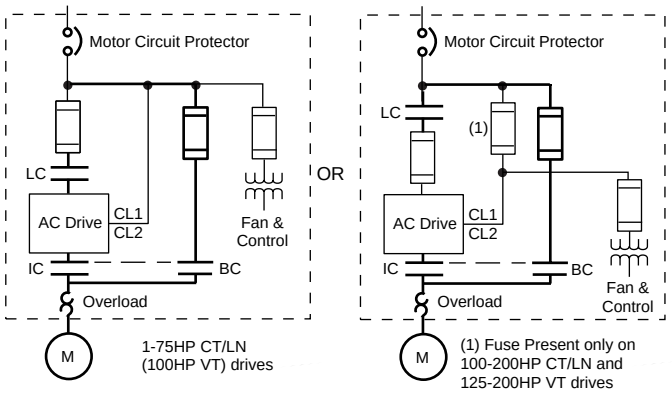
ISOLATION AND BYPASS SCHEMES

3-Contactor Isolation/Bypass with Single Disconnect

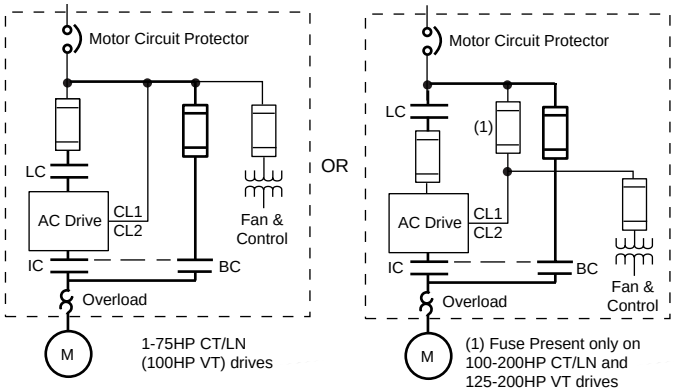


Code K

Standard Iso/bypass features:

- IEC contactors with Class 10 overloads
- 22k AIC short circuit rating
- AFC (green lens) and BYPASS (amber lens) pilot lights door mounted on bypass control island
- AFC-OFF-BYPASS selector switch door mounted on bypass control island
- Three wire control of line contactor

Available with 1-200 hp AC drives only



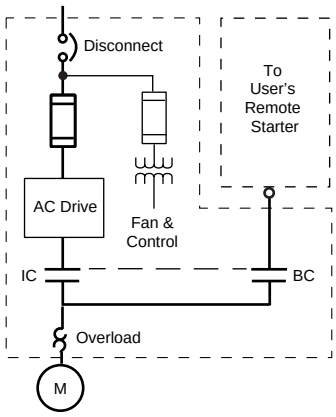
Code J

Standard Iso/bypass features:

- IEC contactors with Class 10 overloads
- 65k AIC short circuit rating
- Bypass fuse not included. Class J or RK-1 required
- AFC (green lens) and BYPASS (amber lens) pilot lights door mounted on bypass control island
- AFC-OFF-BYPASS selector switch door mounted on bypass control island
- Three wire control of line contactor

Available with 1-200 hp AC drives only

2-Contactor Isolation/Transfer with Single Disconnect



Code I

Standard Iso/transfer features:

- IEC contactors with Class 10 overloads (1-200 hp)
- NEMA contactors with Class 20 overloads (250-400 hp)
- Isolation and transfer allows for use of external combination starter, reduced voltage starter or solid state reduced voltage starter as emergency full speed bypass
- 22k AIC short circuit rating
- AFC (green lens) and BYPASS (amber lens) pilot lights door mounted on bypass control island
- AFC-OFF-BYPASS selector switch door mounted on bypass control island

Available with 1-400 hp AC drives only

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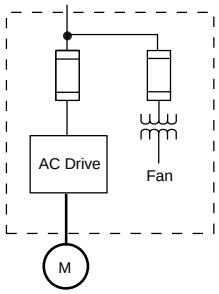
NON-BYPASS SCHEMES

No Contactors without Disconnect



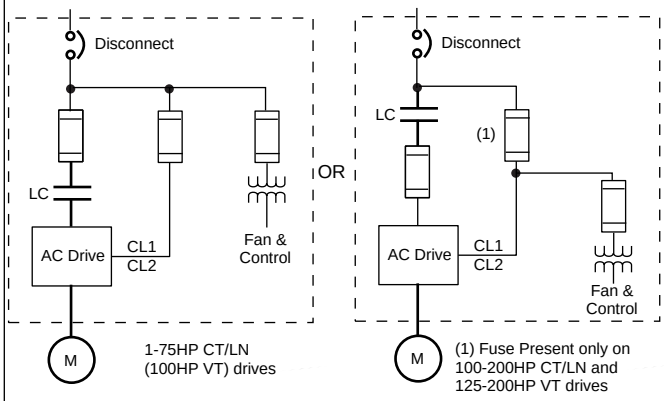
Code A

Standard features:

- 65k AIC short circuit rating

Available with 1-200 hp AC drives only

Line Isolation Contactor with Single Disconnect



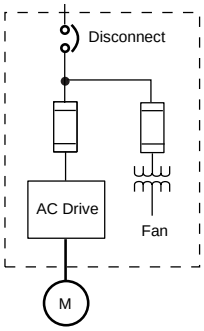
Code H

Standard features:

- IEC line contactor
- 22k AIC short circuit rating: 100-200 hp CT; 125-200 hp VT
- 65k AIC short circuit rating: 1-75 hp CT;
- 1-100 hp VT
- Three wire control of line contactor

Available with 1-400 hp AC drives only

No Contactors with Single Disconnect



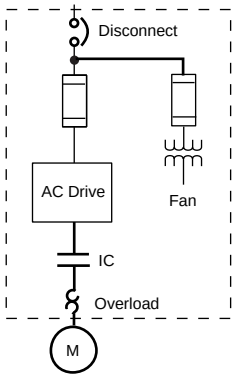
Code B

Standard features:

- 65k AIC short circuit rating

Available with 1-400 hp AC drives only

Output Isolation Contactor with Single Disconnect



Code G

Standard features:

- IEC output contactor with Class 10 overloads
- 65k AIC short circuit rating
- Isolates motor for the AC drive

Available with 1-400 hp AC drives only

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Six categories of control modifications provide user flexibility

- Meters
- General Purpose Control Devices
- Special Purpose Control Devices
- Dynamic Braking
- I/O Extension Module
- Miscellaneous Modifications

Meters

Digital and analog meters may be selected to provide indication of speed, amperes, volts or watts. These meters are in addition to the door mounted keypad display. The keypad display has the following built in metering functions.

Door Mounted Keypad Display Functions

Speed Reference (Hz)	DC Bus Voltage (volts)
Output Frequency (Hz)	Motor Thermal State (%)
Output Current (amps)	Drive Thermal State (%)
Motor Torque (%)	Elapsed Time Indication (hours)
Output Power (%)	Motor RPM (scalable)
Output Voltage (kw)	Machine Speed Reference (scalable)
Line Voltage (volts)	Machine Speed (scalable)

The Digital and Analog meter functions along with their alpha-numeric modifications are listed. These meters are door mounted on the control island with space for a maximum of two meters. When selecting meter(s), use selection 1 column for the first meter and selection column 2 for the second meter.

Modifications		Digital & Analog Meter Functions
Selection 1	Selection 2	
A07	A08	Analog percent speed meter scaled 0 to 120% of base speed
B07	B08	Analog percent current scaled 0 to 200% of rated output current
C07	C08	Analog percent volts scaled 0 to 120% of rated output voltage
D07	D08	Analog percent power scaled 0 to 200% of rated output power
E07	E08	Digital ammeter (amperes) scaled 0 to 2 times rated output amperes
F07	F08	Digital voltmeter (voltage) scaled 0 to 1.1 times rated output voltage
G07	G08	Digital speed meter (frequency) scaled 0 to 72 Hz output frequency
H07	H08	Digital power meter (kilowatts/horsepower) scaled 0 to 2.0 times rated output horsepower
J07	J08	Digital percent current scaled 0 to 120 % rated output current
K07	K08	Digital percent volts scaled 0 to 110 % rated output voltage
L07	L08	Digital percent speed scaled 0 to 120 % of base speed
M07	M08	Digital percent power scaled 0 to 200 % rated output power

General Purpose Control Devices

These door mounted operator controls provide digital and analog inputs for commanding drive speed and start/stop functions. The digital and analog input terminals are active only when the keypad is programmed for Terminal Mode of operation.

NOTE: Switching from terminal mode to keypad mode will inhibit all digital and analog inputs terminals. The enclosed AC drive product door mounted keypad serves as a programmer of drive parameters and display functions.

Mod A09	**Start/stop push buttons with out manual speed potentiometer**
	Provides Start/Stop push buttons mounted on the door mounted control island. These pushbuttons control the starting and stopping of the connected motor. Speed may be adjusted by a remote manual speed potentiometer. Note: Use of the keypad to adjust speed is not possible when the start/stop pushbuttons are active in the terminal mode.

Mod B09	**Start/stop push buttons with manual speed potentiometer**
	Provides Start/Stop push buttons and manual speed potentiometer mounted on the door mounted control island. These pushbuttons control the starting and stopping of the connected motor. Speed may be adjusted by the door mounted manual speed potentiometer.

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Mod C09	**Start/stop push buttons, Hand/auto selector switch with out manual speed potentiometer**
	Provides Start/Stop push buttons and a Hand/Auto selector switch mounted on the door mounted control island. The Hand/Auto selector switch is used to select between the AI1 and AI2 analog inputs. In the Hand position the start/stop push buttons are active (3 wire control) and speed may be adjusted by a remote manual speed potentiometer. In the Auto position the AC drive may be started and stopped by a remote contact (user supplied) (2 wire control). The speed may be adjusted by a 4-20 madc signal to analog input reference AI2. The stop push button is active for both Hand and Auto modes. Note: Use of the keypad to adjust speed is not possible when the start/stop pushbuttons and Hand/auto switch are active in the terminal mode.
Mod D09	**Start/stop push buttons, Hand/auto selector switch with manual speed potentiometer**
	Provides Start/Stop push buttons, Hand/Auto selector switch and manual speed potentiometer mounted on the door mounted control island. The Hand/Auto selector switch is used to select between the AI1 and AI2 analog inputs. In the Hand position the start/stop push buttons are active (3 wire control) and speed may be adjusted by the manual speed potentiometer. In the Auto position the AC drive may be started and stopped by a remote contact (user supplied) (2 wire control). The speed may be adjusted by a 4-20 madc signal to analog input reference AI2. The stop push button is active for both Hand and Auto modes
Mod E09	**Stop pushbutton and forward/reverse push buttons with out manual speed potentiometer**
	Provides Stop, Forward and Reverse push buttons door mounted on the control island. Depressing the forward or reverse push button will start the motor in the desired direction. The stop push button will place the controller in the normal stop mode. The motor speed may be adjusted by a remote manual speed potentiometer or an external speed signal. Note: Use of the keypad to adjust speed is not possible when the stop push-button and forward/ reverse push-button is active in the terminal mode.
Mod F09	**Stop push button, forward and reverse push buttons with manual speed potentiometer**
	Provides Stop, Forward and Reverse push buttons and manual speed potentiometer door mounted on the control island. Depressing the forward or reverse push button will start the motor in the desired direction. The stop push button will place the controller in the normal stop mode. The motor speed may be adjusted by the door mounted manual speed potentiometer.
Mod G09	**Run/stop selector switch with out manual speed potentiometer**
	Provides a two position selector switch door mounted on the control island. Setting the switch in the run position will start the motor. Setting the switch to the stop position will stop the motor. The motor speed may be adjusted by a remote manual speed potentiometer or an external speed signal. Note: Use of the keypad to adjust speed is not possible when the run/stop selector switch is active in the terminal mode.
Mod H09	**Run/stop selector switch with manual speed potentiometer**
	Provides a two position selector switch and manual speed potentiometer door mounted on the control island. Setting the switch in the run position will start the motor. Setting the switch to the stop position will stop the motor. The motor speed may be adjusted by the door mounted manual speed potentiometer.
Mod J09	**Forward-off-reverse selector switch with out manual sped potentiometer**
	Provides a three position selector switch door mounted on the control island. Setting the switch either forward or reverse will start the motor in the desired direction. The motor speed may be adjusted by a remote manual speed potentiometer or an external speed signal. Note: Use of the keypad to adjust speed is not possible when the forward-off-reverse selector switch is active in the terminal mode.
Mod K09	**Forward-off-reverse selector switch with manual speed potentiometer**
	Provides a three position selector switch and manual speed potentiometer door mounted on the control island. Setting the switch to either forward or reverse will start the motor in the desired direction. The motor speed may be adjusted by the door mounted manual speed potentiometer.
Mod L09	**Hand-off-auto selector switch with out manual speed potentiometer**
	Provides a three position selector switch door mounted on the control island. The Hand-Off-Auto selector switch is used to select between the AI1 and AI2 analog inputs. In the Hand position the motor will start and speed may be adjusted by a remote manual speed potentiometer. In the Auto position the motor may be started and stopped by a user supplied remote contact. The speed may be adjusted by a 4-20 madc signal to analog input reference AI2. The off position will stop the motor. Note: Use of the keypad to adjust speed is not possible when the Hand-Off-Auto selector switch is active in the terminal mode.
Mod M09	**Hand-off-automatic selector switch with manual speed potentiometer**
	Provides a three position selector switch and manual speed potentiometer door mounted on the control island. The Hand-Off-Auto selector switch is used to select between the AI1 and AI2 analog inputs. In the Hand position the motor will start and speed may be adjusted by a remote manual speed potentiometer. In the Auto position the motor may be started and stopped by a user supplied remote contact. The speed may be adjusted by a 4-20 madc signal to analog input reference AI2 or the door mounted manual speed potentiometer. The off position will stop the motor
Mod N09	**No General Purpose Devices**
	Provides the door mounted control island with no general purpose control devices.

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Special Purpose Control Devices

These door mounted operator controls provide digital inputs for jog and reversing functions. The digital input terminals are active only when the keypad is programmed for Terminal Mode of operation.

NOTE: Switching from terminal mode to keypad mode will inhibit all digital and analog inputs terminals. The enclosed AC drive product door mounted keypad serves as a programmer of drive parameters and display functions.

Mod A10	**Run-jog selector switch**
	Provides a two position selector switch for selection of the start push-button to be a monetary contact (run) (3-wire control) or maintained contact (jog) (2-wire control). General purpose control Mods; A09 or B09 must be selected for this Mod to function. This selector switch is door mounted on the control island

Mod D10	**Jog forward and Jog reverse push buttons**
	Provides push buttons for jogging the connected motor in the desired direction. Refer to Instruction Manual VDOCO6S305 for information concerning the adjustment of jog speed and jog cycle timer. These pushbuttons are door mounted on the control island.

Mod F10	**Forward/Reverse selector switch**
	Provides a two position selector switch to select the desired direction of motor rotation. Refer to Instruction Manual VDOCO6S305_ for information concerning speed reference inputs for the purpose of adjusting motor speed. This selector switch is door mounted on the control island.

I/O Extension Module

When additional digital or analog inputs/outputs are required an I/O extension module may be selected.

Mod A11	**24V I/O extension module**
	Provides additional 24 V digital/analog inputs and outputs to the drive. The 24 V I/O Extension module has the following inputs/outputs:
	Four 24 Vdc digital logic inputs LI5, LI6, LI7 and LI8.
	Two analog inputs AI3 (Differential) and AI4.
	Two relay outputs R3 and R4 (programmable).
	One current loop output A03 (0-20 ma or 20-4 ma, 250 W input impedance)

Dynamic Braking

When the motor along with its connected mechanical load must be stopped faster than the normal coast time, the dynamic braking modification should be selected.

Mod D15	**Dynamic Braking**
	Provides a resistor and overload protection mounted in a self ventilated enclosure mounted on top of the drive enclosure. This resistor will absorb the regenerative energy from an AC motor to provide internal braking action. For additional information refer to the application section of this catalog.

Miscellaneous modifications

These modifications provide a variety of functions to meet certain application requirements. This extra flexibility offers the ultimate in Build to Order capability of an AC Drive.

Mod A16	**'Power On' Red Pilot Light**
	Provides a red pilot light that illuminates when power is applied to the drive. This pilot light is an LED type door mounted on the control island.

Mod B16	**'Fault' Yellow Pilot Light**
	Provides a yellow pilot light that illuminates when the drive is faulted. This pilot light is an LED type door mounted on the control island.

Mod C16	**'Jog' Green Pilot Light**
	Provides a green pilot light that illuminates when the jog push-button is depressed on the drive. This pilot light is an LED type door mounted on the control island.

Mod D16	**'Run' Green Pilot Light**
	Provides a green pilot light that illuminates when the drive is supplying an output frequency to the connected motor. This pilot light is an LED type door mounted on the control island. Note: When power circuits C through K are selected an AFC Run (green)and Bypass Run (amber) pilot light is provided on the door mounted bypass control island.

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Mod E16	**'Hand & Auto' Yellow Pilot Lights** Provides two yellow pilot lights that illuminate when HAND or AUTO mode have been selected. General purpose control Mods; C09, D09, L09 or M09 must be selected for this Mod to function. These pilot lights are of the LED type door mounted on the control island
Mod F16	**'Forward & Reverse' Green Pilot Lights** Provides two green pilot lights that illuminate when the FORWARD or REVERSE mode has be selected. These pilot lights are of the LED type door mounted on the control island.
Mod G16	**'Fault' Yellow Pilot Light with Reset Push button** Provides a illuminated push-button with a yellow lens that illuminates when the drive is faulted. This illuminated push-button is an LED type door mounted on the control island. Once the condition which initiated the fault has been corrected, the drive may be reset by depressing the push button and the yellow light will extinguish. The faults that are re-setable with this modification are: * Undervoltage * Motor Overload * Input Phase Loss * Loss of Follower * Drive Over temperature * DC Bus Overvoltage * Overvoltage
Mod H16	**Bypass 3 wire control** Provides start/stop pushbuttons (3-wire control) for bypass contactor operation. These pushbuttons are door mounted on the bypass control island. Upon loss of power, the bypass operation must be restarted using the momentary start push button.
Mod J16	**Bypass duty cycle timer** Prevents rapid cycling of line power to the motor when operating in bypass mode. When line power is removed from the motor, line power cannot be reapplied in the bypass mode until the time delay set on the CTR relay timer. The CTR relay timer is factory set for 10 seconds. It can be adjusted to meet user's process requirements within the range of 10 to 180 seconds.
Mod K16	**Automatic transfer to Bypass** Provides an automatic transfer to bypass for full speed operation , should a fault condition occur tripping the drive off line.
Mod L16	**Additional Control VA** Increases the standard control transformer by 50 VA beyond that required for operation of the control functions.
Mod M16	**Power Isolator controls** Provides two pushbuttons (3-wire control) for manual operation of the line contactor. The two push buttons are labeled CONVERTER PWR ENABLE and CONVERTER PWR DISABLE. These pushbuttons are door mounted on the bypass control island.
Mod O16	**Oversized enclosure (50-75 HP CT / 60-100 HP VT only)** Provides a 90" H x 32" W x 20" D free standing enclosure for substitution of the standard 42" H x 32" W x 20" D wall mounted enclosure.
Mod P16	**Auto start relay** Provides an interface for remote contact (120 V rated) to start the drive or bypass and Hand/Auto selector switch for the bypass. The Hand/Auto selector switch provides hand or auto operation in the bypass mode with extra terminal points for user supplied float switches and other level alarm functions.
Mod Q16	**3-15 PSI input follower** Provides a 3-15 PSI follower from the users pneumatic source. The motor speed will be proportional to the 3-15 PSI pneumatic signal.
Mod R16	**Convert Pilot Light(s) to Push-to-Test** Provides push-to-test of all pilot lights selected previously, except the Power On Pilot Light (A16).
Mod S16	**24VDC power supply** Provides an auxiliary 24 Vdc, 320 ma power supply, installed within the drive. May be used to power devices that exceed the rating of the drive 24 Vdc supply.
Mod T16	**Motor Elapsed Time Meter (ETM)** Provides elapsed time indication of motor operation from both drive and bypass contactor functions. The Motor Elapsed Time meter is a 0 to 99999.9 digit in HOURS, non-resettable display rated 120 Vac, 60 Hz with a Type 12 sealed face. This meter is door mounted on the control island.
Mod W16	**'Fast Stop' push button** Provides a pushbutton for modifying the set deceleration ramp rate to the minimum ramp rate of 0.1 seconds. This pushbutton is door mounted on the control island. This function will allow the drive to decelerate the motor as quickly as possible within the operating limits of the controller configuration (braking selection) without causing nuisance tripping.
Mod Y16	**Omit door mounted keypad** Removes the keypad and LED display from outside the enclosure door. The keypad will remain on the basic drive unit within the enclosure.

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Control Options

Form modifications within the Q200 series will cover control circuit engineered features for the Class 8839 enclosed AC drives.

Mod Q200	**Auxiliary Drive Run Contacts**
	Provides (3) Form 'C' contacts rated 5 A @ 120 Vac wired to terminal blocks (9080 GM6) for customer use.

• Available on all configurations.

Mod Q201	**Auxiliary Bypass Run Contacts**
	Provides (3) Form 'C' contacts rated 5 A @ 120 Vac wired to terminal blocks (9080 GM6) for customer use.

• Available only for Power Circuits C, D, E, F, I, J or K.

Mod Q202	**Auxiliary Drive Fail Contacts**
	Provides (3) Form 'C' contacts rated 5 A @ 120 Vac wired to terminal blocks (9080 GM6) for customer use.

• Available on all configurations.

Mod Q203	**Auxiliary auto mode contacts**
	Provides an auxiliary AFC mode (auto) contact which will energize a relay with (3) Form 'C' contacts rated 5 A @ 120 Vac wired to terminal blocks (9080 GM6) for customer use.

• Available on all configurations.

Mod Q204	**Motor Space Heater**
	Provides control circuit contacts, 120 V, 150-500 VA supply and fusing wired to terminals for customer use. *Note: Specify VA requirements at time of order entry in the 'Engineering Notes' field within Q2C.*

• Available on all configurations.

Mod Q205	**Signal loss follower option board**
	Provides the 52010-055-50 intended for 4-20 mAdc control loop applications where upon the loss of input signal it is desired to retain the output signal at the last input signal level. The module provides isolated 4-20 mAdc to 0-10 Vdc conversion and a normally open alarm relay contact for signal loss alert. The module operates from +24 Vdc power supply and is mounted on a standard 35 mm DIN rail within the drive enclosure.

• Available on all configurations.

Mod Q206	**Emergency power off push-button**
	Provides a shunt trip modified molded case switch or circuit breaker where a push-pull maintained mushroom head push-button energizes the shunt trip coil and instantaneously opens to shut down power supplied to the AC drive in the AFC mode and/or bypass mode, coasting to an uncontrolled stop.

• Available on configurations except Power Circuit A.

Mod Q207	**Inhibit/shutdown sequence (instantaneous operation)**
	Provides a relay circuit operating in the fail safe mode where a remote initiating contact opens the relay, deenergizes and instantaneously shuts the AC drive down in the AFC mode (hand or auto) and/or in the bypass mode (hand or auto).

• Available on all configurations. • Not available if option Q208 is selected.

Mod Q208	**Inhibit/shutdown sequence (timed operation)**
	Provides a relay circuit operating in the fail safe mode where a remote initiating contact opens the relay, deenergizes and after a specified time shuts the AC drive down in the AFC mode (hand or auto) and/or in the bypass mode (hand or auto).

• Available on all configurations. • Not available if option Q207 is selected.

Mod Q209	**Check valve sequence (gravity type)**
	Provides relay circuitry sequenced from a check valve limit switch. A valve closed position limit switch will energize the relay that will give a run permissive to the AC drive in the AFC mode (hand or auto) and/or in the bypass mode (hand or auto). A valve closed position limit switch will deenergize a timer relay such that if this relay is not deenergized within a specified time period, the AC drive will shut down in the AFC mode (hand or auto) and/or in the bypass mode (hand or auto).

• Available on all configurations. • Not available if option Q210 is selected.

Mod Q210	**Check valve sequence (motorized type)**
	Provides relay circuitry sequenced from a check valve limit switch. A valve closed position limit switch will energize relays that will initiate a remote valve operating solenoid limited to 50VA and give a run permissive to the AC drive in the AFC mode (hand or auto) and/or in the bypass mode (hand or auto). A valve closed position limit switch will deenergize a timer relay such that if this relay is not deenergized within a specified time period, the AC drive will shut down in the AFC mode (hand or auto) and/or in the bypass mode (hand or auto).

• Available on all configurations. • Not available if option Q209 is selected.

Mod Q211	**Seal water solenoid - without pressure switch feedback**
	Provides relay which will energize a remote seal water solenoid limited to 50 VA during AC drive operation in the AFC mode (hand or auto) and/or in the bypass mode (hand or auto).

• Available on all configurations. • Not available if option Q212 is selected.

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Mod Q212	**Seal water solenoid - with pressure switch feedback**
	Provides relay which will energize a remote seal water solenoid limited to 50 VA during AC drive operation. Additionally, the remote initiating contact will open the relay, deenergizing and after a specified time shuts the AC drive down in the AFC mode (hand or auto) and/or in the bypass mode (hand or auto).

• Available on all configurations. • Not available if option Q211 is selected.

Mod Q213	**Moisture detection relay circuit (without relay)**
	Provides 24 V or 120 V control power to a moisture detection relay device, either electronic or electro-mechanical prewired with socket or mounting space only. Note: Customer supplies relay. Details concerning type must also be provided at time of order entry in the 'Engineering Notes' field within Q2C.

• Available on all configurations. • Not available if option Q214 is selected.

Mod Q214	**Moisture detection relay circuit (with relay)**
	Provides 24 V or 120 V control power to a moisture detection relay device, either electronic or electro-mechanical mounted and prewired. Note: Details concerning type must be provided at time of order entry in the 'Engineering Notes' field within Q2C.

• Available on all configurations. • Not available if option Q213 is selected.

Enclosure & miscellaneous modifications

Form modifications within the Q300 series will cover enclosure and miscellaneous enclosed features for the Class 8839 enclosed AC drive.

Mod Q300	**ID Engraved Nameplates**
	Provides a lamacoid nameplate, engraved with equipment designation. Note: Specify legend, black letters/white background or white letters/black background at time of order entry in 'Engineering Notes' field within Q2C.

• Available on all configurations.

Mod Q301	**Permanent wire markers**
	Provides permanent type wire markers on control wiring assemblies.

• Available on all configurations.

Mod Q302	**Fan Filter assembly**
	Provides fan filter assembly 52012-856-50 factory mounted on 250-400 hp @ 460 V units only.

• Available only on 250-400 hp @ 460 V units.

Mod Q303	**ANSI #49 Enclosure paint**
	Provides option to configure enclosure paint to industry standard ANSI#49 gray paint in lieu of RAL 7032 (Beige).

• Available on all configurations • Not available if option Q304 is selected.

Mod Q304	**ANSI #61 Enclosure paint**
	Provides option to configure enclosure paint to industry standard ANSI#61 light gray paint in lieu of RAL 7032 (Beige).

• Available on all configurations. • Not available if option Q303 is selected.

Power Options

Form modifications within the Q400 series will cover engineered power circuit configurations for the Class 8839 enclosed AC drive.

Mod Q400	**Top mounted 5% Line Reactor**	
	Provides a factory mounted and wired 5% impedance line reactor to minimize harmonic distortion (IEEE 519) back onto the ac line.	
	460 V Ratings: 1-75 hp 100 hp (VT only)	208/230 V Ratings: 1-50 hp (208 V/230 V)

• Not available if options D15 or Q401 is selected.
• Option Q400 available offering is up to 75 hp CT/LN (100 hp VT) for 460 V rated units. Line reactors are separately mounted and wired by customer on 100 hp CT (125 hp VT) & up for 460 V rated units.

Mod Q401	**Top mounted motor protecting filter**
	Provides a factory mounted and wired dv/dt filter on the drive output for long motor lead lengths considerations in excess of our published guidelines, up to 1000 feet.
	460 V Ratings only: 1-75 hp 100 hp (VT only)

• Not available if option D15 or Q400 is selected.
• Q401 available offering is for 460 V rated units only up to 75 hp CT/LN (100 hp VT).
• Not available for 208 V and 230 V ratings.

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Class 8839 Enclosed AC Drives
Recommended Spare Parts

460 V Type CT and VTLN Recommended Spare Parts List

VTLN only available through 75 HP.

Description	1-5 HP	7.5-10 HP	15-20 HP	25-40 HP	50-75 HP	100-200 HP	250-350 HP
Standard:							
Control Basket w/Keypad	VX4A66CK1	VX4A66CK1	VX4A66CK1	VX4A66CK1	VX4A66CK1	VX4A66CK2	VX4A66CK2
Power Board	VX5A663U41N4 (1-3 hp) VX5A662U72N4 (5 hp)	VX5A662U90N4 (7.5 hp) VX5A662D12N4 (10 hp)	VX5A66D16N4 (15 hp) VX5A66D23N4 (20 hp)	VX5A66D33N4 (25-30 hp) VX5A66D46N4 (40 hp)	VX5A66D54N4 (50 hp) VX5A66D64N4 (60 hp) VX5A66D79N4 (75 hp)	VX5A66C10N4(100 hp) VX5A66C13N4(125 hp) VX5A66C15N4(150hp) VX5A66C19N4 (200 hp)	VX5A66C23N4(250hp) VX5A66C28N4(300hp) VX5A66C31N4 (350 hp)
IGBT Module Kit	Included with Power Board	Included with Power Board	VZ3IM2050M1201(15 hp) VZ3IM2075M1201(20 hp)	VZ3IM2100M1201 (25-30 hp) VZ3IM2150M1201 (40 hp)	VZ3IM2150M1201(50 hp) VZ3IM2200M1201(60 hp) VZ3IM2300M1201(75 hp)	VZ3IM2300M1202 (100 hp) VZ3IM2400M1202 (125-200 hp)	VZ3IM1400M1207 (250-300 hp) VZ3IM1500M1207 (350 hp)
Gate Driver Board	Included with Power Board	Included with Power Board	VX5A66103 (15 hp) VX5A66104 (20 hp)	VX5A66105 (25-30 hp) VX5A66106 (40 hp)	VX5A66107(50 hp) VX5A66108 (60 hp) VX5A66109 (75 hp)	Included with IGBT Module Kit	Included with IGBT Module Kit
Diode Rectifier	Included with Power Board	Included with Power Board	VZ3DM6075M1601	VZ3DM2080M1606 (25-30 hp) VZ3DM2100M1601 (40 hp)	VZ3DM2160M1606	VZ3DM2170M1602 (100-125 hp) VZ3DM2260M1602 (150 hp) VZ3DM2350M1602 (200 hp)	VZ3DM2600M1602
Heatsink Fan	VZ3V661 (1-3 hp) VZ3V662 (5 hp)	VZ3V663	VZ3V664	VZ3V665	VZ3V665	VZ3V670	VZ3V666
Drive Cooling Fan	N/A	N/A	N/A	VZ3V6654	VZ3V6654 VZ3V6655	VZ3V671	VZ3V669
AC Line Fuse	25430-10500 (1 hp) 25430-11000 (2 hp) 25430-11500 (3 hp) 25430-12000 (5 hp)	25417-20350 (7.5 hp) 25417-20450 (10 hp)	25499-00653 (15 hp) 25499-00655 (20 hp)	25499-00655 (25-30 hp) 25417-21250 (40 hp)	25417-21250 (50 hp) 25417-21500 (60 hp) 25417-21750 (75 hp)	25418-62401(100-125 hp) 25418-62501 (150 hp) 25418-62600 (200 hp)	VY1ALF700V700(250hp) VY1ALF800V700(300hp) VY1ALF900V700(350hp)
Red "Run" LED	25501-03043	25501-03043	25501-03043	25501-03043	25501-03043	25501-03043	25501-03043
Green "On" LED	25501-03044	25501-03044	25501-03044	25501-03044	25501-03044	25501-03044	25501-03044
Yellow "Fault" LED	25501-03045	25501-03045	25501-03045	25501-03045	25501-03045	25501-03045	25501-03045
T1 Transformer Primary Fuse	25430-20050	25430-20050	25430-20050	25430-20161	25430-20161	25430-20400 (Type 1) 25430-20281 (Type 12)	N/A
T1 Transformer Secondary Fuse	25430-20080	25430-20080	25430-20080	25430-20281	25430-20281	25430-20625 (Type 1) 25430-20400 (Type 12)	N/A
T2 Transformer Primary Fuse	25430-20050	25430-20050	25430-20074	25430-20281	25430-20281	25430-20400 (100 hp) 25430-20400 (125-200 hp Type 12) 25430-20500 (125-200 hp Type 1)	N/A
T2 Transformer Secondary Fuse	25430-20080	25430-20080	25430-20126	25430-20400	25430-20400	25430-20625 (100 hp) 25430-20625 (125-200 hp Type 12) 25430-20900 (125-200 hp Type 1)	N/A
4.5" Enclosure Fan	26016-31531	26016-31531	26016-31531	26016-31531	N/A	N/A	N/A
7" Enclosure Fan	N/A	N/A	N/A	26016-31100	26016-31100	26016-31100	N/A
10" Enclosure Fan	N/A	N/A	N/A	N/A	N/A	52015-392-52	N/A
Modifications:							
Bypass							
Incandescent Pilot Light Bulb	25501-01020	25501-01020	25501-01020	25501-01020	25501-01020	25501-01020	25501-01020
Option Board (MOD A11)							
24 VDC I/O Extension	VW3A66201T	VW3A66201T	VW3A66201T	VW3A66201T	VW3A66201T	VW3A66201T	VW3A66201T
Additional Control VA (MOD L16)							
T1 Transformer Primary Fuse	25340-20074	25340-20074	25430-20126	25430-20281	25430-20281	25430-20400 (Type 1) 25430-20281 (Type 12)	N/A
T1 Transformer Secondary Fuse	25430-20126	25430-20126	25430-20161	25430-20400	25430-20400	25430-20625 (Type 1) 25430-20400 (Type 12)	N/A
T2 Transformer Primary Fuse	25340-20074	25340-20074	25430-20126	25430-20281	25430-20281 (50 hp) 25430-20400 (60-75 hp)	25430-20400 (100-125 hp Type 12) 25430-20500 (100-125 hp Type 1) 25430-20500(150-200 hp)	N/A
T2 Transformer Secondary Fuse	25430-20126	25430-20126	25430-20200	25430-20400	25430-20400 (50 hp) 25430-20625 (60-75 hp)	25430-20625 (100-125 hp Type 12) 25430-20900 (100-125 hp Type 1) 25430-20900(150-200 hp)	N/A
Dynamic Braking							
DB Transistor Module	Included with Power Board	Included with Power Board	VZ3IM1025M1001	VZ3IM2050M1201	VZ3IM2100M1201(50 hp) VZ3IM2150M1201 (60-75 hp)	VZ3IM1300M1202	VZ3IM1400M1208(250 hp) VZ3IM1300M1208 (300-350 hp)

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460 V Type VT Recommended Spare Parts List

Description -	1-7.5 HP	10-15 HP	20-25 HP	30-50 HP	60-100 HP	125-200 HP	250-400 HP
Standard:							
Control Basket w/Keypad	VX4A66CK1	VX4A66CK1	VX4A66CK1	VX4A66CK1	VX4A66CK1	VX4A66CK2	VX4A66CK2
Power Board	VX5A663U41N4 (1-3 hp) VX5A662U54N4 (5 hp) VX5A662U72N4 (7.5 hp)	VX5A662U90N4 (10 hp) VX5A662D12N4 (15 hp)	VX5A66D16N4 (20 hp) VX5A66D23N4 (25 hp)	VX5A66D33N4 (30-40 hp) VX5A66D46N4 (50 hp)	VX5A66D54N4 (60 hp) VX5A66D64N4 (75 hp) VX5A66D79N4 (100 hp)	VX5A66C10N4 (125 hp) VX5A66C13N4(150hp) VX5A66C15N4 (200 hp)	VX5-A66C23N4 (250-300 hp) VX5-A66C28N4 (350 hp) VX5-A66C31N4 (400 hp)
IGBT Module Kit	Included with Power Board	Included with Power Board	VZ3IM2050M1201(20 hp) VZ3IM2075M1201(25 hp)	VZ3IM2100M1201 (30-40 hp) VZ3IM2150M1201(50 hp)	VZ3IM2150M1201(60 hp) VZ3IM2200M1201(75 hp) VZ3IM2300M1201 (100 hp)	VZ3IM2300M1202 (125 hp) VZ3IM2400M1202 (150-200 hp)	VZ3IM1400M1207 (250-350 hp) VZ3IM1500M1207 (400 hp)
Gate Driver Board	Included with Power Board	Included with Power Board	VX5A66103 (20 hp) VX5A66104 (25 hp)	VX5A66105 (30-40 hp) VX5A66106 (50 hp)	VX5A66107 (60 hp) VX5A66108 (75 hp) VX5A66109 (100 hp)	Included with IGBT Module Kit	Included with IGBT Module Kit
Diode Rectifier	Included with Power Board	Included with Power Board	VZ3DM6075M1601	VZ3DM2080M1606 (30-40 hp) VZ3DM2100M1601 (50 hp)	VZ3DM2160M1606	VZ3DM2170M1602 (125-150 hp) VZ3DM2260M1602 (200 hp)	VZ3DM2600M1602
Heatsink Fan	VZ3V661 (1-5 hp) VZ3V662 (7.5 hp)	VZ3V663	VZ3V664	VZ3V665	VZ3V665	VZ3V670	VZ3V666
Drive Cooling Fan	N/A	N/A	N/A	VZ3V6654	VZ3V6654 VZ3V6655	VZ3V671	VZ3V669
AC Line Fuse	25430-10500 (1 hp) 25430-11000 (2 hp) 25430-11500 (3 hp) 25430-12000 (5-7.5 hp)	25417-20450	25499-00655	25499-00655 (30 hp) 25417-21250 (40-50 hp)	25417-21500 (60 hp) 25417-21750 (75 hp) 25417-22250 (100 hp)	25418-62401(125-150 hp) 25418-62501 (200 hp)	VY1ALF700V700 (250-300 hp) VY1ALF800V700(350 hp) VY1ALF900V700(400 hp)
Red "Run" LED	25501-03043	25501-03043	25501-03043	25501-03043	25501-03043	25501-03043	25501-03043
Green "On" LED	25501-03044	25501-03044	25501-03044	25501-03044	25501-03044	25501-03044	25501-03044
Yellow "Fault" LED	25501-03045	25501-03045	25501-03045	25501-03045	25501-03045	25501-03045	25501-03045
T1 Transformer Primary Fuse	25430-20050	25430-20050	25430-20050	25430-20161	25430-20161	25430-20400 (Type 1) 25430-20281 (Type 12)	N/A
T1 Transformer Secondary Fuse	25430-20080	25430-20080	25430-20080	25430-20281	25430-20281	25430-20625 (Type 1) 25430-20400 (Type 12)	N/A
T2 Transformer Primary Fuse	25430-20050	25430-20050 (10 hp) 25430-20074 (15 hp)	25430-20074 (20 hp) 25430-20126 (25 hp)	25430-20281	25430-20281	25430-20500 (Type 1) 25430-20400(Type12)	N/A
T2 Transformer Secondary Fuse	25430-20080	25430-20080 (10 hp) 25430-20126 (15 hp)	25430-20126 (20 hp) 25430-20161 (25 hp)	25430-20400	25430-20400	25430-20900 (Type 1) 25430-20625(Type12)	N/A
4.5" Enclosure Fan	26016-31531	26016-31531	26016-31531	26016-31531	N/A	N/A	N/A
7" Enclosure Fan	N/A	N/A	N/A	26016-31100	26016-31100	26016-31100	N/A
10" Enclosure Fan	N/A	N/A	N/A	N/A	N/A	52015-392-52	N/A
Modifications:							
Bypass							
Incandescent Pilot Light Bulb	25501-01020	25501-01020	25501-01020	25501-01020	25501-01020	25501-01020	25501-01020
Option Board (MOD A11)							
24 VDC I/O Extension	VW3A66201T	VW3A66201T	VW3A66201T	VW3A66201T	VW3A66201T	VW3A66201T	VW3A66201T
Additional Control VA (MOD L16)							
T1 Transformer Primary Fuse	25340-20074	25340-20074	25430-20126	25430-20281	25430-20281	25430-20400 (Type 1) 25430-20281 (Type 12)	N/A
T1 Transformer Secondary Fuse	25430-20126	25430-20126	25430-20161	25430-20400	25430-20400	25430-20625 (Type 1) 25430-20400 (Type 12)	N/A
T2 Transformer Primary Fuse	25340-20074	25430-20074 (10 hp) 25430-20126 (15 hp)	25430-20126	25430-20281	25430-20400	25430-20400 (125 hp Type 12) 25430-20500 (150-200 hp Type 12) 25430-20500 (125-200 hp Type 1)	N/A
T2 Transformer Secondary Fuse	25430-20126	25430-20126 (10 hp) 25430-20200 (15 hp)	25430-20200	25430-20400	25430-20625	25430-20625 (125 hp Type 12) 25430-20900 (150-200 hp Type 12) 25430-20900 (125-200 hp Type 1)	N/A
Dynamic Braking							
DB Transistor Module	Included with Power Board	Included with Power Board	VZ3IM1025M1001	VZ3IM2050M1201	VZ3IM2100M1201(60 hp) VZ3IM2150M1201 (75-100 hp)	VZ3IM1300M1202	VZ3IM1400M1208 (250-300 hp) VZ3IM1300M1208 (350-400 hp)

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Class 8839 Enclosed AC Drives
Recommended Spare Parts

208/230 V Type CT and VTLN Recommended Spare Parts List

Description	1-3 HP	5-7.5 HP	10-15 HP	20-30 HP	40 HP
Standard:					
Control Basket w/Keypad	VX4A66CK1	VX4A66CK1	VX4A66CK1	VX4A66CK1	VX4A66CK1
Power Board	VX5A662U41M2 (1-3 hp)	VX5A662U72M2 (5 hp) VX5A662U90M2 (7.5 hp)	VX5A66D12M2 (10 hp) VX5A66D234M2 (15 hp)	VX5A66D234M2 (20 hp) VX5A66D335M2 (25-30 hp)	VX5A66D466M2
IGBT Module Kit	Included with Power Board	Included with Power Board	VZ3IM2075M0601 (10 hp) VZ3IM2150M0601 (15 hp)	VZ3IM2150M0601 (20 hp) VZ3IM2200M0601 (25-30 hp)	VZ3IM2300M0601
Gate Driver Board	Included with Power Board	Included with Power Board	VX5A66112 (10 hp) Included with Power Board (15 hp)	Included with Power Board	Included with Power Board
Diode Rectifier	Included with Power Board	Included with Power Board	VZ3DM6075M1601 (10 hp) VZ3DM2080M1606 (15 hp)	VZ3DM2080M1606 (20 hp) VZ3DM2100M1601 (25-30 hp)	VZ3DM2160M1606
Heatsink Fan	VZ3V662	VZ3V663	VZ3V664 (10 hp) VZ3V665 (15 hp)	VZ3V665	VZ3V665
Drive Cooling Fan	N/A	N/A	VZ3V6654 (15 hp)	VZ3V6654	VZ3V6654 VZ3V6655
AC Line Fuse	25430-10800 (1 hp) 25430-11500 (2 hp) 25430-12000 (3 hp)	25430-13000 (5 hp) 25417-20400 (7.5 hp)	25417-20500 (10 hp) 25499-00654 (15 hp)	25417-20900 (20 hp) 25417-21100 (25 hp) 25417-21250 (30 hp)	25417-21750
Red "Run" LED	25501-03043	25501-03043	25501-03043	25501-03043	25501-03043
Green "On" LED	25501-03044	25501-03044	25501-03044	25501-03044	25501-03044
Yellow "Fault" LED	25501-03045	25501-03045	25501-03045	25501-03045	25501-03045
T1 Transformer Primary Fuse	25430-20126	25430-20126	25430-20126 (10 hp) 25430-20500 (15 hp/230V) 25430-20600 (15 hp/208V)	25430-20500 (230V) 25430-20600 (208V)	25430-20500 (230V) 25430-20600 (208V)
T1 Transformer Secondary Fuse	25430-20080	25430-20080	25430-20080 (10 hp) 25430-20400 (15 hp)	25430-20400	25430-20400
T2 Transformer Primary Fuse	25430-20161	25430-20161	25430-20280 (10 hp/230V) 25430-20350 (10 hp/208V) 25430-20500 (15 hp/230V) 25430-20600 (15 hp/208V)	25430-20500 (20-25 hp/230V) 25430-20600 (20-25 hp/208V) 25430-20750 (30 hp)	25430-20750
T2 Transformer Secondary Fuse	25430-20126	25430-20126	25430-20200 (10 hp) 25430-20400 (15 hp)	25430-20400 (20-25 hp) 25430-20625 (30 hp)	25430-20625
4.5" Enclosure Fan	26016-31531 (w/Bypass)	26016-31531	26016-31531	26016-31531 (20 hp)	N/A
7" Enclosure Fan	N/A	N/A	26016-31100 (15 hp)	26016-31100	26016-31100
Modifications:					
Bypass					
Incandescent Pilot Light Bulb	25501-01020	25501-01020	25501-01020	25501-01020	25501-01020
Option Board (MOD A11)					
24 VDC I/O Extension	VW3A66201T	VW3A66201T	VW3A66201T	VW3A66201T	VW3A66201T
Additional Control VA (MOD L16)					
T1 Transformer Primary Fuse	25430-20126	25430-20161	25430-20280 (10 hp/230V) 25430-20350 (10 hp/208V) 25430-20500 (15 hp/230V) 25430-20600 (15 hp/208V)	25430-20500 (230 V) 25430-20600 (208 V)	25430-20500 (230 V) 25430-20600 (208 V)
T1 Transformer Secondary Fuse	25430-20080	25430-20126	25430-20200 (10 hp) 25430-20400 (15 hp)	25430-20400	25430-20400
T2 Transformer Primary Fuse	25430-20280 (230 V) 25430-20350 (208 V)	25430-20280 (230 V) 25430-20350 (208 V)	25430-20280 (10 hp/230V) 25430-20350 (10 hp/208V) 25430-20500 (15 hp/230V) 25430-20600 (15 hp/208V)	25430-20500 (20 hp/230V) 25430-20600 (20 hp/208V) 25430-20750 (25-30 hp)	25430-20750
T2 Transformer Secondary Fuse	25430-20200	25430-20200	25430-20200 (10 hp) 25430-20400 (15 hp)	25430-20400 (20 hp) 25430-20625 (25-30 hp)	25430-20625
Dynamic Braking					
DB Transistor Module	Included with Power Board	Included with Power Board	VZ3IM1060M0601 (10 hp) VZ3IM2075M0601 (15 hp)	VZ3IM2075M0601 (20 hp) VZ3IM2100M0601 (25-30 hp)	VZ3IM2150M0601

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208/230 V Type VT Recommended Spare Parts List

DESCRIPTION	1-3 HP	5-10 HP	15-25 HP	30 HP	40-50 HP
Standard:					
Control Basket w/Keypad	U41 VX4A66CK1	U72 (5, 7.5) D12 (10) VX4A66CK1	D23 VX4A66CK1S260	D33 VX4A66CK1	D46 VX4A66CK1
Power Board	VX5A662U41M2	VX5A662U72M2 (5-7.5 hp) VX5A66D12M2 (10 hp)	VX5A66D234M2	VX5A66D335M2	VX5A66D466M2
IGBT Module Kit	Included with Power Board	Included with Power Board (5-7.5 hp) VZ3IM2075M0601 (10 hp)	VZ3IM2150M0601	VZ3IM2200M0601	VZ3IM2300M0601
Gate Driver Board	Included with Power Board	Included with Power Board (5-7.5 hp) VX5A66112 (10 hp)	Included with Power Board	Included with Power Board	Included with Power Board
Diode Rectifier	Included with Power Board	Included with Power Board (5-7.5 hp) VZ3DM6075M1601 (10 hp)	VZ3DM2080M1606	VZ3DM2100M1601	VZ3DM2160M1606
Heatsink Fan	VZ3V662	VZ3V663 (5-7.5 hp) VZ3V664 (10 hp)	VZ3V665	VZ3V665	VZ3V665
Drive Cooling Fan	N/A	N/A	VZ3V6654	VZ3V6654	VZ3V6654 VZ3V6655
AC Line Fuse	25430-10800 (1 hp) 25430-11500 (2 hp) 25430-12000 (3 hp)	25430-13000 (5 hp) 25417-20400 (7.5 hp) 25417-20500 (10 hp)	25499-00654 (15 hp) 25417-20900 (20 hp) 25417-21100 (25 hp)	25417-21250	25417-21750 (40 hp) 25499-00657 (50 hp)
Red "Run" LED	25501-03043	25501-03043	25501-03043	25501-03043	25501-03043
Green "On" LED	25501-03044	25501-03044	25501-03044	25501-03044	25501-03044
Yellow "Fault" LED	25501-03045	25501-03045	25501-03045	25501-03045	25501-03045
T1 Transformer Primary Fuse	25430-20126	25430-20126	25430-20500 (230V) 25430-20600 (208V)	25430-20500 (230V) 25430-20600 (208V)	25430-20500 (230V) 25430-20600 (208V)
T1 Transformer Secondary Fuse	25430-20080	25430-20080	25430-20400	25430-20400	25430-20400
T2 Transformer Primary Fuse	25430-20161	25430-20161 (5-7.5 hp) 25430-20280 (10 hp/230V) 25430-20350 (10 hp/208V)	25430-20500 (230V) 25430-20600 (208V)	25430-20750	25430-20750
T2 Transformer Secondary Fuse	25430-20126	25430-20126	25430-20400	25430-20625	25430-20625
4.5" Enclosure Fan	26016-31531 (w/Bypass)	26016-31531	26016-31531 (15-20 hp)	N/A	N/A
7" Enclosure Fan	N/A	N/A	26016-31100	26016-31100	26016-31100
Modifications:					
Bypass					
Incandescent Pilot Light Bulb	25501-01020	25501-01020	25501-01020	25501-01020	25501-01020
Option Board (MOD A11)					
24 VDC I/O Extension	VW3A66201T	VW3A66201T	VW3A66201T	VW3A66201T	VW3A66201T
Additional Control VA (MOD L16)					
T1 Transformer Primary Fuse	25430-20126	25430-20161 (5-7.5 hp) 25430-20280 (10 hp/230V) 25430-20350 (10 hp/208V)	25430-20500 (230V) 25430-20600 (208V)	25430-20500 (230 V) 25430-20600 (208 V)	25430-20500 (230 V) 25430-20600 (208 V)
T1 Transformer Secondary Fuse	25430-20080	25430-20126 (5-7.5 hp) 25430-20200 (10 hp)	25430-20400	25430-20400	25430-20400
T2 Transformer Primary Fuse	25430-20280 (230 V) 25430-20350 (208 V)	25430-20280 (230 V) 25430-20350 (208 V)	25430-20500 (15-20 hp/230V) 25430-20600 (15-20 hp/208V) 25430-20750 (25 hp)	25430-20750	25430-20750
T2 Transformer Secondary Fuse	25430-20200	25430-20200	25430-20400 (15-20 hp) 25430-20625 (25 hp)	25430-20625	25430-20625
Dynamic Braking					
DB Transistor Module	Included with Power Board	Included with Power Board (5-7.5 hp) VZ3IM1060M0601 (10 hp)	VZ3IM2075M0601	VZ3IM2100M0601	VZ3IM2150M0601

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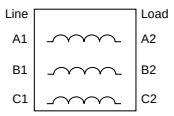
The Class 8839 ALTIVAR 66 Enclosed AC Drives are designed to operate from industrial power systems with normal AC line conditions without the need of additional line impedance from either an isolation transformer or a line reactor. However, when abnormal line conditions exist, additional line impedance may be required. Typically, line reactors are used for:

- Minimize the input rms current to the AC drive ratings
- Lower the available fault current on high fault distribution systems
- Limit the total harmonic voltage distortion from the AC drive at the point of common coupling to align with IEEE 519 guidelines
- Prevent AC drive nuisance tripping due to transient overvoltages from power factor correction capacitor switching

HP Rating	208 V Line Reactor (separate mounted)	230 VAC Line Reactor (separate mounted)	460 VAC Line Reactor (separate mounted)	Enclosed Factory Configured Modification
1	RL–00412	RL–00412	RL–00212	Q400
1.5	RL–00812	RL–00812	–	Q400
2	RL–00812	RL–00812	RL–00413	Q400
3	RL–01212	RL–01212	RL–00413	Q400
5	RL–01812	RL–01812	RL–00813	Q400
7.5	RL-02512	RL–02512	RL–01213	Q400
10	RL–03512	RL–03512	RL–01813	Q400
15	RL–04512	RL–04512	RL–02513	Q400
20	RL–05512	RL–05512	RL–03513	Q400
25	RL–08012	RL–08012	RL–03513	Q400
30	RL–10012	RL–08012	RL–04513	Q400
40	RL–13012	RL–10012	RL–05513	Q400
50	RL–16012	RL–13012	RL–08013	Q400
60	–	–	RL–08013	Q400
75	–	–	RL–10013	Q400
100	–	–	RL–13013	Q400 (VT only)
125	–	–	RL–16013	–
150	–	–	RL–20013	–
200	–	–	RL–25013	–
250	–	–	RL–32013	–
300	–	–	RL–40013	–
350	–	–	RL–50013	–
400	–	–	RL–50013	–



Line Reactors:

1. Part numbers are referenced and manufactured by MTE, Inc.
2. Harmonic compensated up to 150% of nominal current ratings
3. 5% nominal reactance
4. Offered in Type 1 general purpose enclosures
5. Intended for separate mounting and wired by the user with the exception of ratings offering Q400 modification.
6. Refer to the following publications on the subject of harmonics and benefits of drive isolation transformers:
   - — **8803PD9402–**Power Systems Harmonics–Cause and Effects of AC Drives.
   - — **7460HO9501**–Drive Isolation Transformers-Application, Selection and Specification Data
   - — **7460PD9501–** Drive Isolation Transformers–Solutions to Power Quality

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Low pass filters can be used on the output of the Class 8839 ALTIVAR 66 Enclosed AC Drive to decease the stress of resonant frequencies on the attached motor. While low pass filters are not necessary for most installations, they do provide substantial benefits in installations involving long motor leads:

- 460 V or higher rated AC drives
- 1–25 hp rated units, if cable lead lengths are in excess of 75 feet
- 30–400 hp rated units, if cable lead lengths are in excess of 300 feet.
- Use of a non–inverter duty rated motor(s)
- Existing general purpose motors subject to retrofit to an AC drive

The motor protecting output filters combine inductance, capacitance and resistance to form a low pass filter. This filter will lower the dV/dt levels to prevent exciting the natural resonant wire frequency of the motor cables. Motors compliant to NEMA MG–1 Part 31 guidelines do not require the use of motor protecting output filters.

HP Rating @ 460 V	KLC Filter (separate mounting)	Enclosed Factory Configured Modification
1–2	KLC4BE	Q401
3	KLC6BE	Q401
5	KLC8BE	Q401
7.5	KLC12BE	Q401
10	KLC16BE	Q401
15	KLC25BE	Q401
20–25	KLC35BE	Q401
30	KLC45BE	Q401
40	KLC55BE	Q401
50-60	KLC80BE	Q401
75	KLC110BE	Q401
100	KLC130BE	Q401(VT only)
125	KLC160BE	–
150	KLC200BE	–
200	KLC250BE	–
250	KLC300BE	–
300	KLC360BE	–
350	KLC420BE	–
400	KLC480BE	–

Motor Protecting Output Filters:

1. Part number references are per Trans-Coil, Inc.
2. KLC filters are designed for cable lead lengths ranging from 50 to 1000 feet.
3. KLC filters include 1.5% nominal reactance at 480V
4. KLC filters are enclosed in Type 1 general purpose enclosures
5. KLC filters are intended for separate mounting and wiring by user

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Drive Isolation transformers are designed for maximum benefit when applied to an AC drive. In addition to the functional comparison of a line reactor, drive isolation transformers are normally used for one of the following reasons over a standard line reactor:

1. Match system voltage to drive rating.
2. Meet local or plant codes that require isolation.
3. Capable of correcting line voltage unbalance conditions commonly seen with open delta and corner grounded delta distribution systems.
4. Provides continuity of service for nuisance grounding.
5. Reduces drive induced currents in supply feeder ground and limit ground fault currents.
6. Isolate the electrical common mode noise generated in solid state controllers from the distribution system.

The ALTIVAR 66 AC drives use a diode bridge input stage which does not produce the electrical switching transients common to converters using SCRs such as DC drives. The Class 8839 ALTIVAR 66 Enclosed AC drives have a high fault withstand capability (up to 65,000 A depending upon configuration). For these reasons, Square D does not suggest the use of a drive isolation transformer for isolation purposes unless the system requires one or more of the six functions listed above.

Three Phase 60 Hz Class B (IEEE 597-1983)

HP Rating	kVA	Catalog Number
1-5	7.5	7T( )HDIT
7.5	11	11T( )HDIT
10	15	15T( )HDIT
15	20	20T( )HDIT
20	27	27T( )HDIT
25	34	34T( )HDIT
30	40	40T( )HDIT
40	51	51T( )HDIT
50	63	63T( )HDIT
60	75	75T( )HDIT
75	93	93T( )HDIT
100	118	118T( )HDIT
125	145	145T( )HDIT
150	175	175T( )HDIT
200	220	220T( )HDIT
250	275	275T( )HDIT
300	440	440T( )HDIT
400	550	550T( )HDIT

Voltage Codes

Code	Primary	Secondary
142	230 Delta	230Y/132
143	230 Delta	460Y/265
144	460 Delta	230Y/132
145	460 Delta	460Y/265
146	575 Delta	230Y/132
147	575 Delta	460Y/265

Notes:

To complete catalog number:
Select the voltage required from chart. Insert the voltage code number in place of the ( ) in the catalog number.

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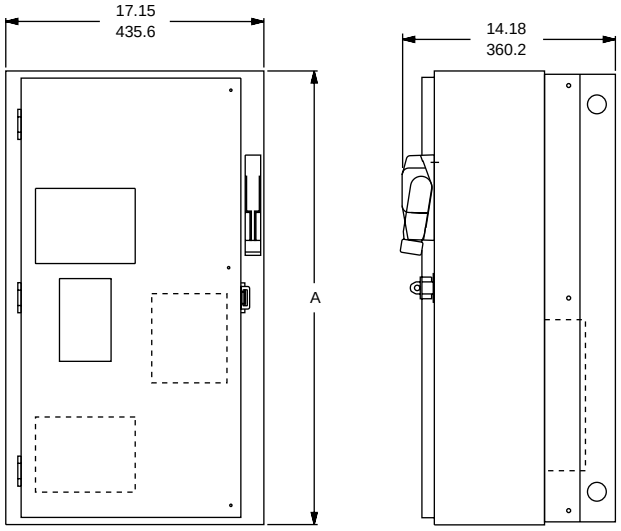
Optimized and Integrated Construction (Wall Mount)
1–10 HP @ 208–230 V, and 1–20 HP (25 HP VT) @ 460 V



FRONT VIEW SIDE VIEW

Horsepower	Voltage	Type	Power Circuit	A	Weight
1–3 hp 1–5 hp 1–7.5 hp	208/230 V 460 V 460 V	CT, LN, VT CT, LN VT	A, B	30.15" 765.8 mm	85 lbs.
5–7.5 hp 7.5–10 hp 10–15 hp	208/230 V 460 V 460 V	CT , LN, VT CT, LN VT	A, B	30.15" 765.8 mm	100 lbs.
10 hp 15–20 hp 20–25 hp	208/230 V 460 V 460 V	CT, LN, VT CT, LN VT	A, B	36.15" 918.2 mm	125 lbs.
1–3 hp 1–5 hp 1–7.5 hp	208/230 V 460 V 460 V	CT, LN, VT CT, LN VT	C, D, G, H, I, J, K	44.15" 1121.4 mm	105 lbs
5–7.5 hp 7.5–10 hp 10–15 hp	208/230 V 460 V 460 V	CT, LN, VT CT, LN VT	C, D, G, H, I, J, K	44.15" 1121.4 mm	120 lbs
10 hp 15–20 hp 20–25 hp	208/230 V 460 V 460 V	CT, LN, VT CT, LN VT	C, D, G, H, I, J, K	48.15" 1223 mm	150 lbs

NOTE: CT = Constant Torque; LN = Low Noise Variable Torque; VT = Variable Torque

More detailed drawings available through quote to cash.

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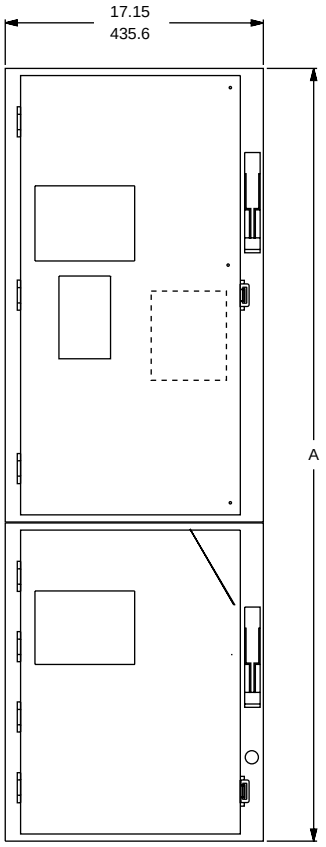
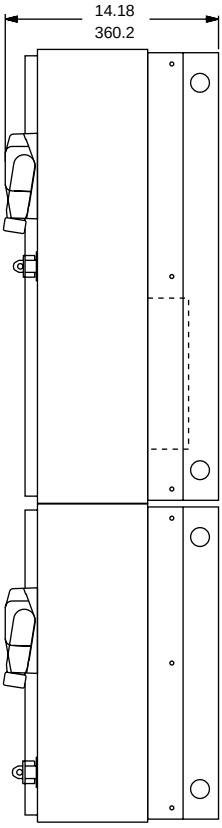
Barriered Construction (Wall Mount)
1–10 HP @ 208/230 V, and 1–20 HP (25 HP VT) @ 460 V



FRONT VIEW



SIDE VIEW

Horsepower	Voltage	Type	Power Circuit	A	Weight
1–3 hp 1–5 hp 1–7.5 hp	208/230 V 460 V 460 V	CT, LN, VT CT, LN VT	E, F	51.36" 1304.5 mm	145 lbs.
5–7.5 hp 7.5–10 hp 10–15 hp	208/230 V 460 V 460 V	CT, LN, VT CT, LN VT	E, F	51.36" 1304.5 mm	165 lbs.
10 hp 15–20 hp 20-25 hp	208/230 V 460 V 460 V	CT, LN, VT CT, LN VT	E, F	57.36" 1456.9 mm	210 lbs.

NOTE: CT = Constant Torque; LN = Low Noise Variable Torque; VT = Variable Torque

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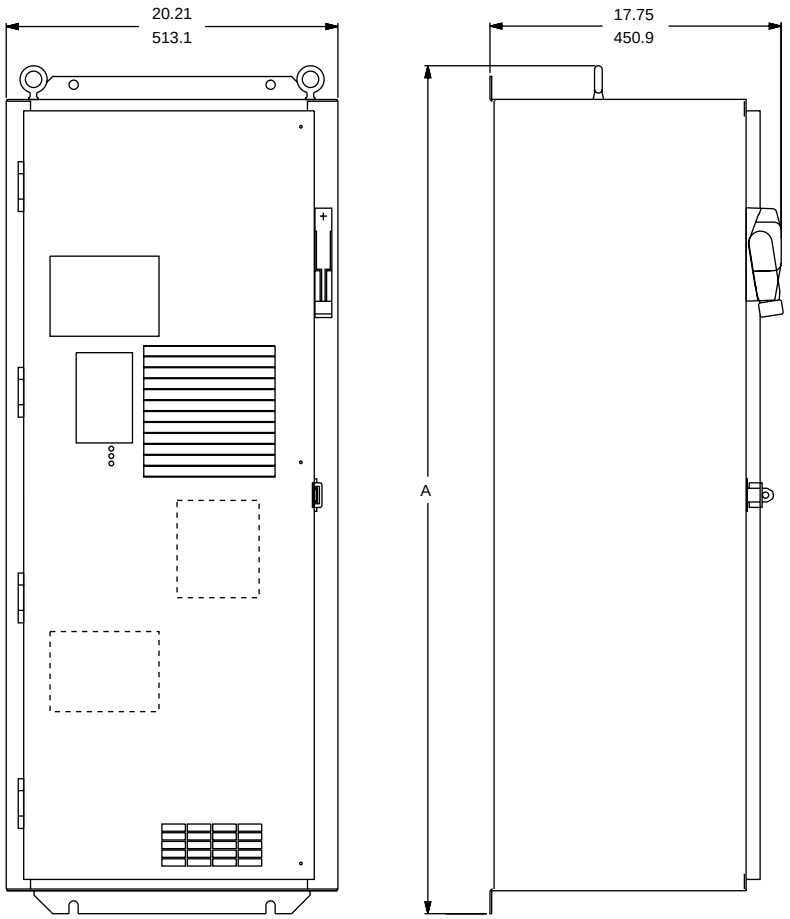
Optimized and Integrated Construction (Wall Mount)
15–20 HP @ 208/230 V, and 25–40 HP (50 HP VT) @ 460 V



FRONT VIEW SIDE VIEW

Horsepower	Voltage	Type	Power Circuit	A	Weight
15–20 hp 25–40 hp 30–50 hp	208/230 V 460 V 460 V	CT, LN, VT CT, LN VT	A, B	51.36" 1304.5 mm	200 lbs.
15-20 hp 25–40 hp 30–50 hp	208/230 V 460 V 460 V	CT, LN, VT CT, LN VT	C, D, G, H, I, J, K	67.63" 1717.8 mm	320 lbs.

NOTE: CT = Constant Torque; LN = Low Noise Variable Torque; VT = Variable Torque

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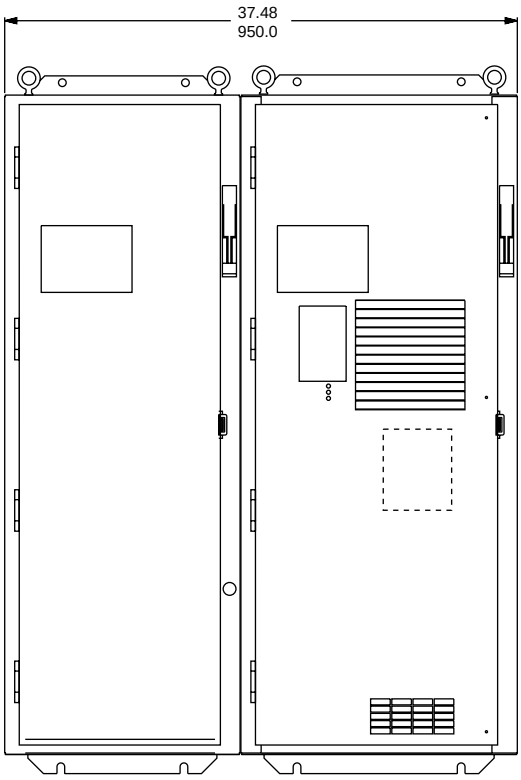
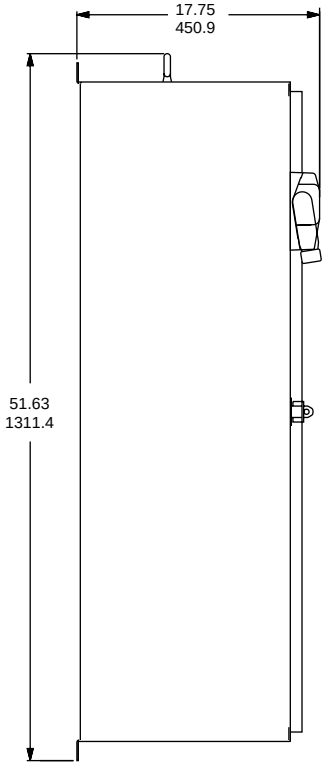
Barriered Construction (Wall Mount)
15–20 HP @ 208/230 V, and 25–40 HP (50 HP VT) @ 460 V



FRONT VIEW



SIDE VIEW

Horsepower	Voltage	Type	Power Circuit	Weight
15–20 hp 25–40 hp 30–50 hp	208/230 V 460 V 460 V	CT, LN, VT CT, LN VT	E, F	350 lbs.

NOTE: CT = Constant Torque; LN = Low Noise Variable Torque; VT = Variable Torque

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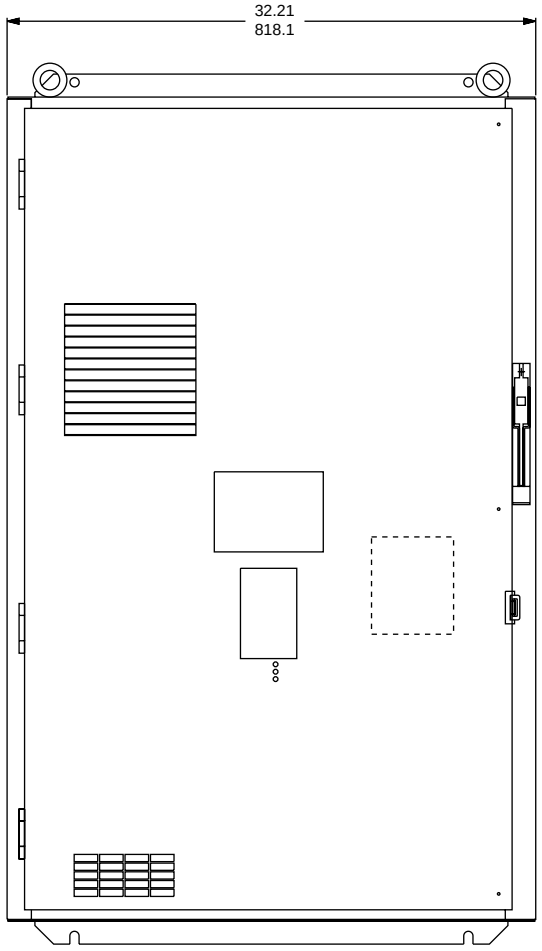
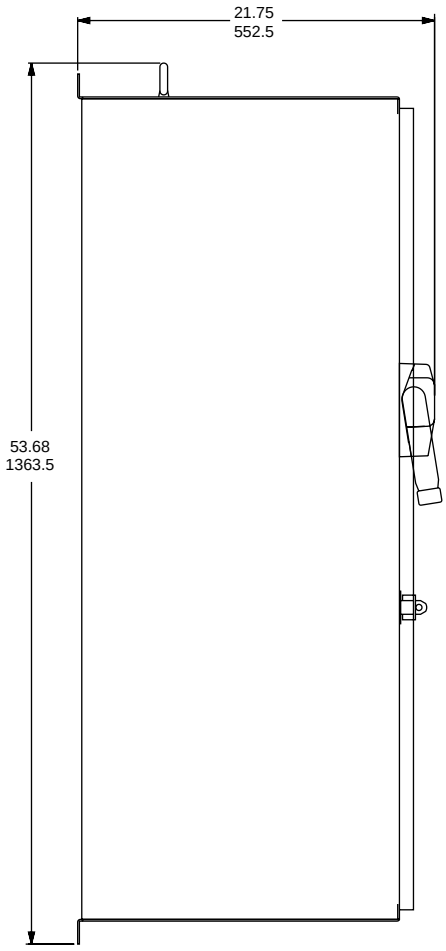
Optimized Construction (Wall Mount)
25–40 HP (50 HP VT @ 208-230 V, and 50–75 HP (100 HP VT) @ 460 V



FRONT VIEW



SIDE VIEW

Horsepower	Voltage	Type	Power Circuit	Weight
25–40 hp 30–50 hp 50–75 hp 60–100 hp	208/230 V 208/230 V 460 V 460 V	CT, LN VT CT, LN VT	A, B	450 lbs.

NOTE: CT = Constant Torque; LN = Low Noise Variable Torque; VT = Variable Torque

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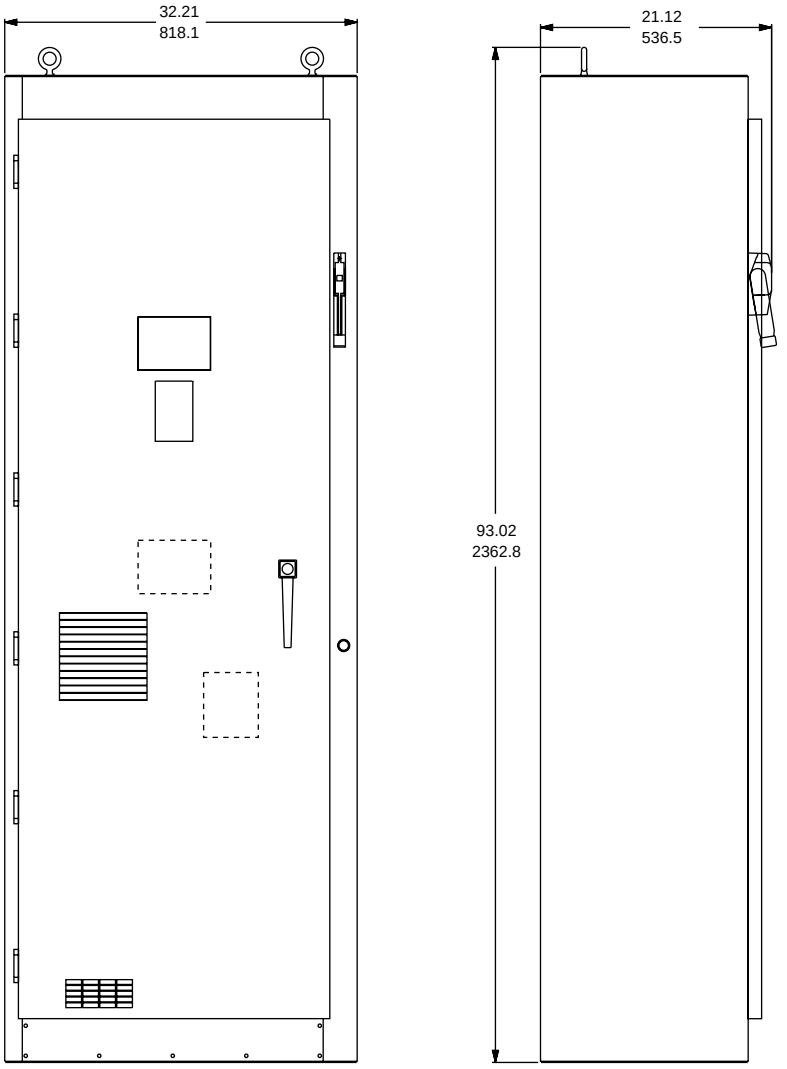
Optimized and Integrated Construction (Floor Mount)
25-40 HP (50 HP VT) @ 208/230 V, and 50-75 HP (100 HP VT) @ 460 V



FRONT VIEW SIDE VIEW

Horsepower	Voltage	Type	Power Circuit	Weight
25–40 hp 30–50 hp 50–75 hp 60–100 hp	208/230V 208/230V 460V 460V	CT, LN VT CT, LN VT	A, B with option O16 or C, D, G, H, I, J, K	700 lbs.
100–200 hp 125–200 hp	460V 460V	CT VT	A, B	800 lbs

NOTE: CT = Constant Torque; LN = Low Noise Variable Torque; VT = Variable Torque.
Option O16 provides for floor mount oversized enclosure in lieu of wall mount configuration.

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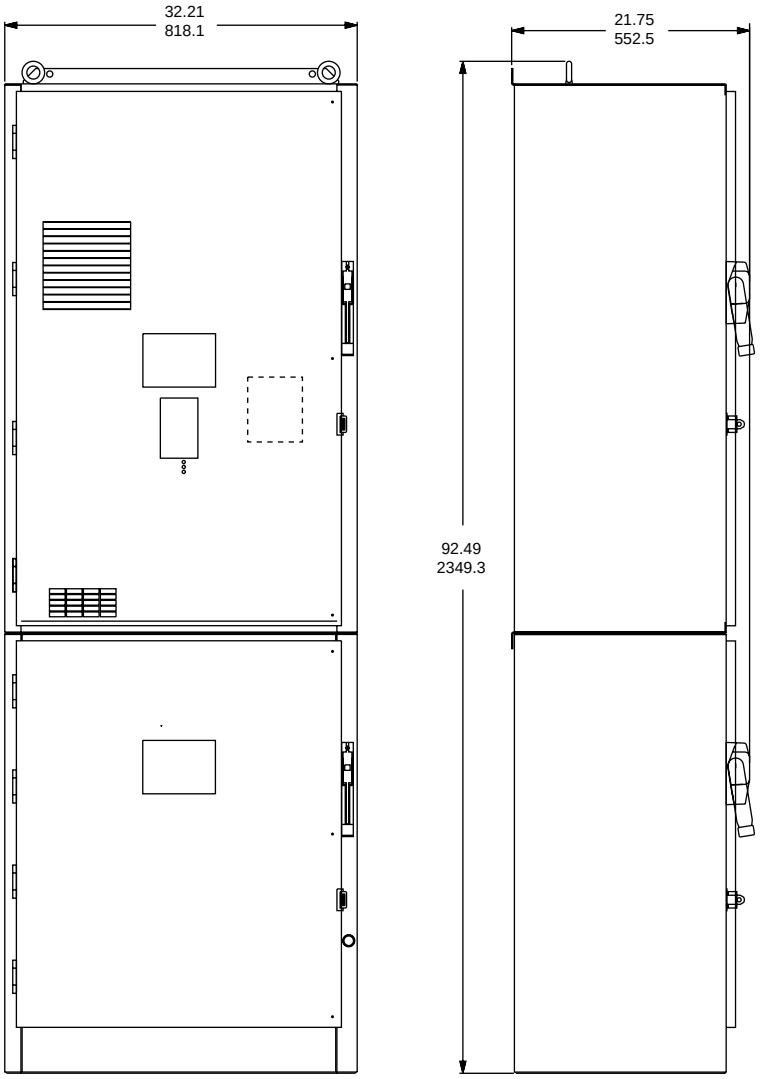
Barriered Construction (Floor Mount)
25–40 HP (50 HP VT) @ 208/230 V, and 50–75 HP (100 HP VT) @ 460 V



FRONT VIEW SIDE VIEW

Horsepower	Voltage	Type	Power Circuit	Weight
25–40 hp 30–50 hp 50–75 hp 60–100 hp	208/230 V 208/230 V 460V 460V	CT, LN VT CT, LN VT	E, F	775 lbs.

NOTE: CT = Constant Torque; LN = Low Noise Variable Torque; VT = Variable Torque

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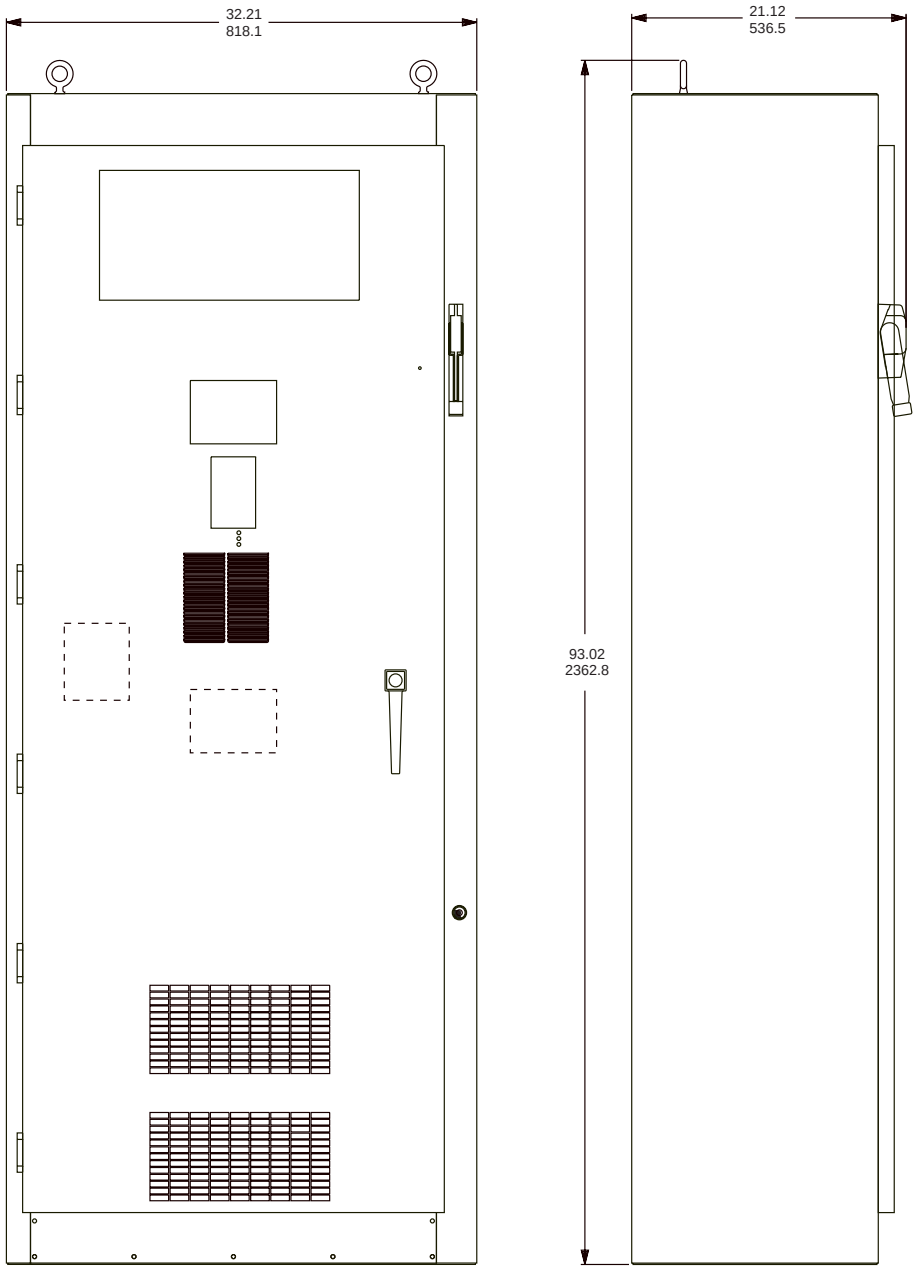
Integrated Construction (Floor Mount)
100–200 HP CT and 125–200 HP VT @ 460 V



FRONT VIEW SIDE VIEW

Horsepower	Voltage	Type	Power Circuit	Weight
100–200 hp 125–200 hp	460 V	CT VT	C, D, G, H, I, J, K	980 lbs.

NOTE: CT = Constant Torque; LN = Low Noise Variable Torque; VT = Variable Torque

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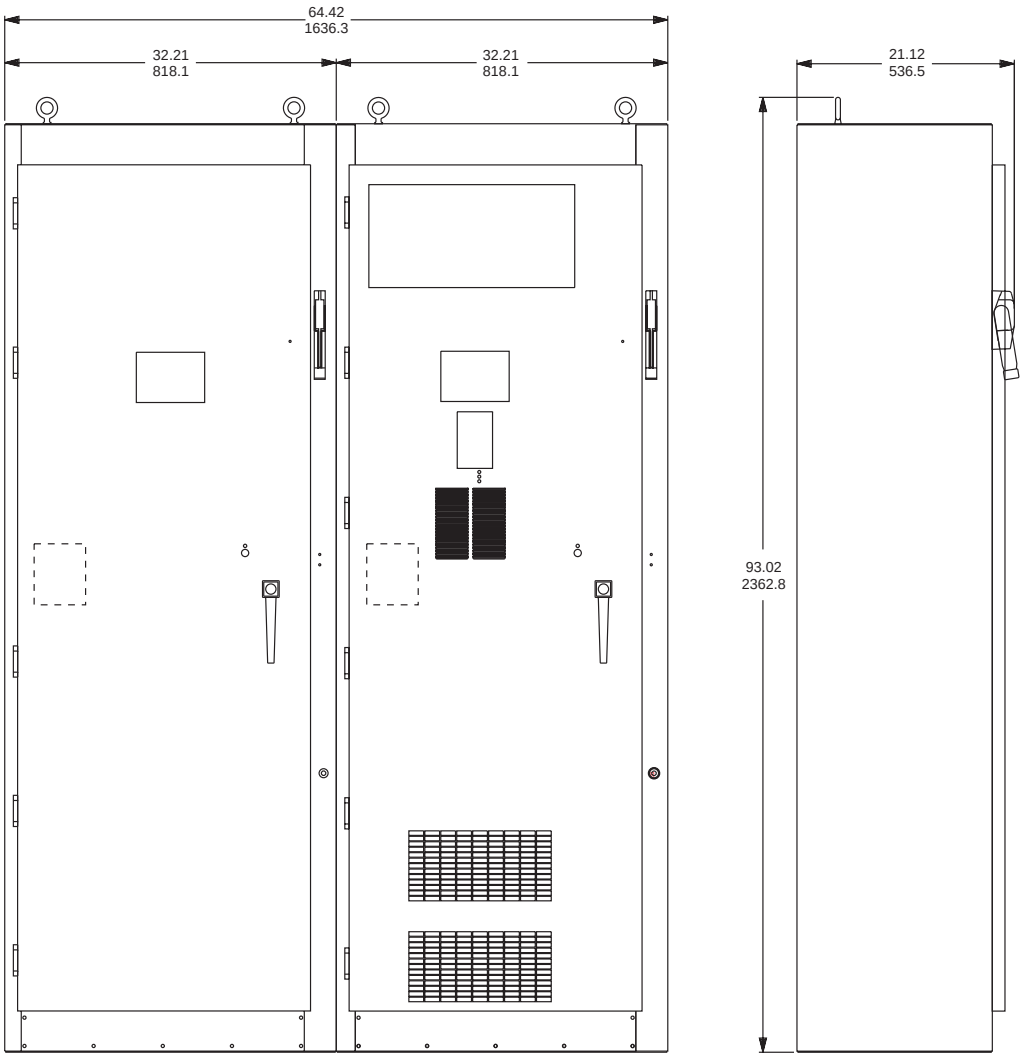
Barriered Construction (Floor Mount)
100–200 HP CT and 125–200 HP VT @ 460 V



FRONT VIEW SIDE VIEW

Horsepower	Voltage	Type	Power Circuit	Weight
100–200 hp 125–200 hp	460 V	CT VT	E, F	1300 lbs.

NOTE: CT = Constant Torque; LN = Low Noise Variable Torque; VT = Variable Torque

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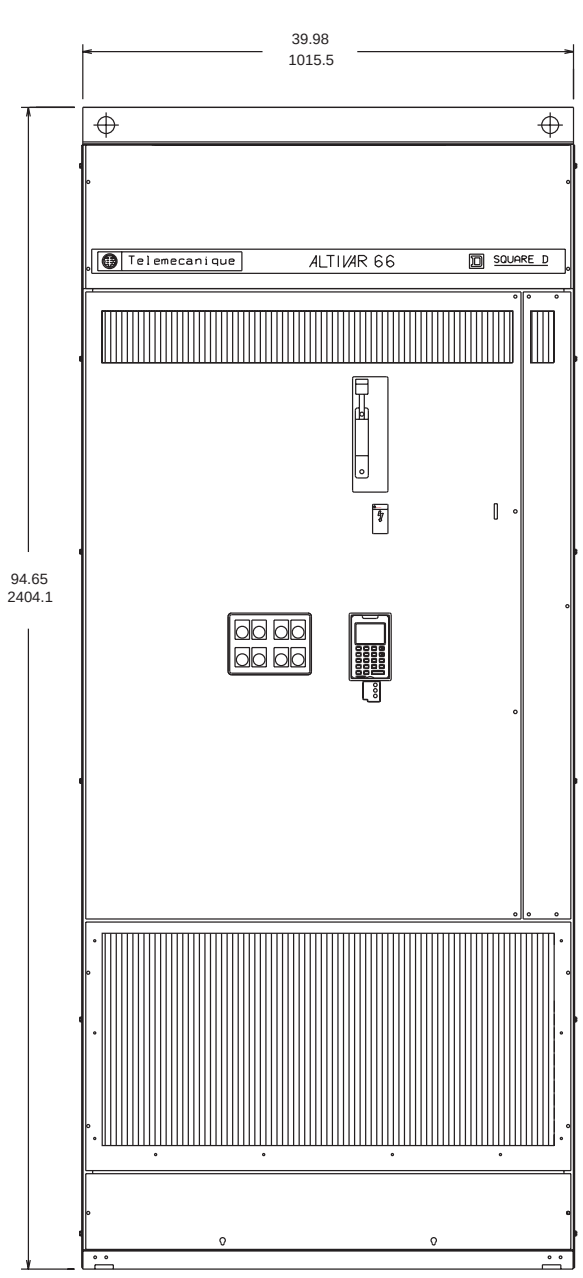
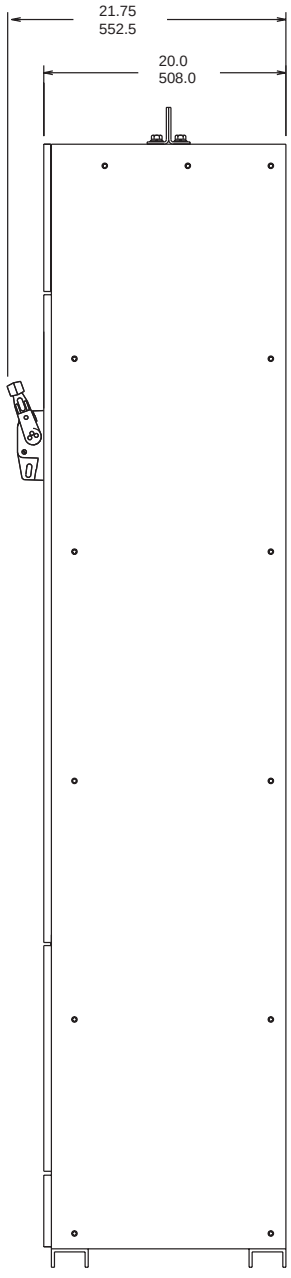
Optimized Construction (Floor Mount)
250–350 CT and 250–400 HP VT @ 460 V



FRONT VIEW



RIGHT SIDE VIEW

Horsepower	Voltage	Type	Power Circuit	Weight
250–350 hp 250–400 hp	460 V	CT VT	B	1400 lbs.

NOTE: CT = Constant Torque; LN = Low Noise Variable Torque; VT = Variable Torque

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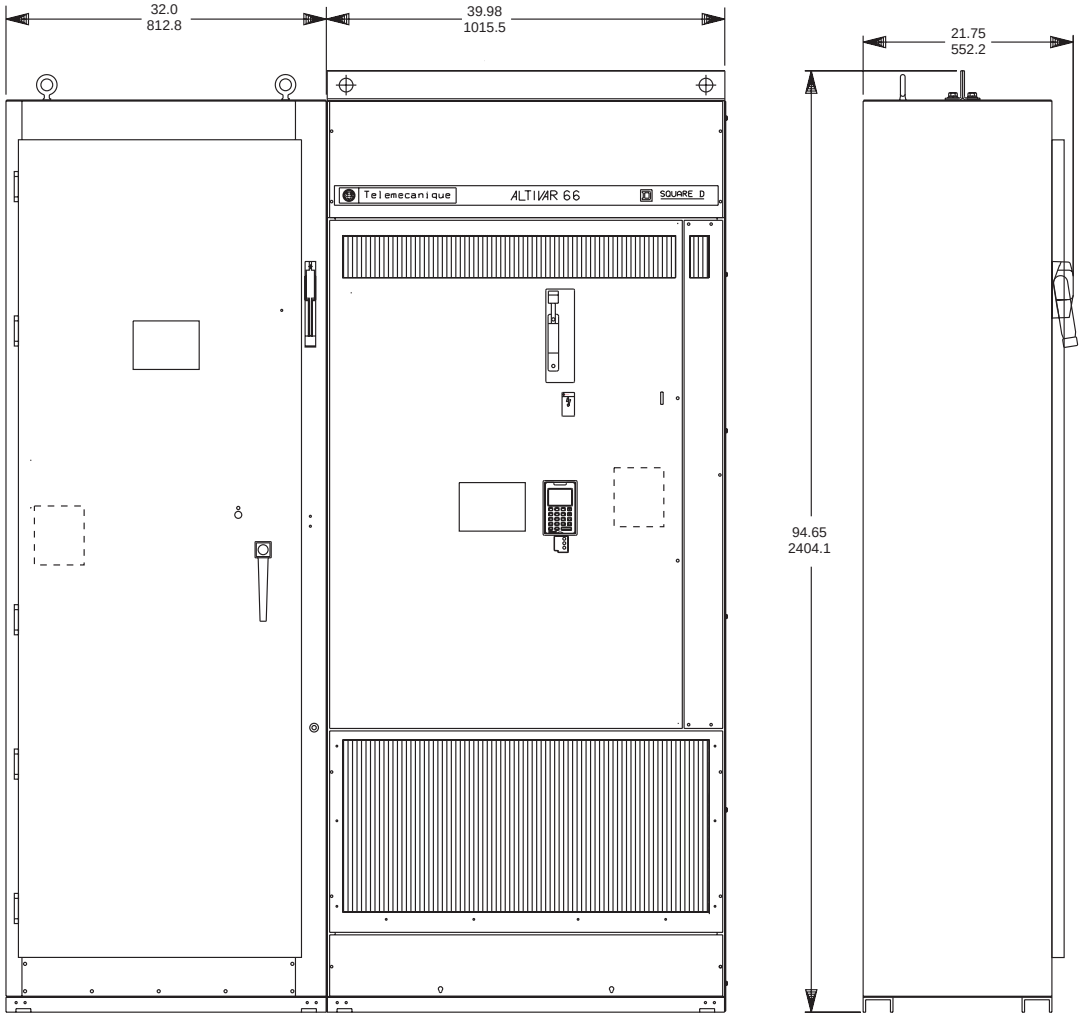
Barriered Construction (Floor Mount)
250–350 HP CT and 250–400 HP VT @ 460 V



FRONT VIEW SIDE VIEW

Horsepower	Voltage	Type	Power Circuit	Weight
250–350 hp 250-400 hp	460 V	CT VT	F, G, I	2200 lbs.

NOTE: CT = Constant Torque; LN = Low Noise Variable Torque; VT = Variable Torque

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When selecting and applying AC Drives, the following items should be considered where they are applicable. Proper selection and application of an AC Drive is essential to ensure reliable operation and maximum performance of the connected motor load. Please consult Product Data Bulletin **SC100 R5/95** "Adjustable Frequency Controllers Application Guide" for further details.

1. AC Drive selection
2. Ambient temperature/altitude
3. AC Line & motor voltage
4. Power factor
5. Harmonics
6. Input currents with and without line reactors
7. Drive isolation transformer
8. Speed range & regulation
9. Accelerating torque
10. Dynamic braking
11. Follower signals
12. PI regulator
13. Bypass operation
14. Motor selection
15. Enclosure types
16. Relay contact ratings

AC Drive Selection

The ALTIVAR AC drive is selected based on the connected motor full load current. AC drives in this catalog are listed by horsepower, voltage and maximum continuous output current ratings that align to the latest NEC ratings. The motor horsepower rating may be used to select the AC drive, provided it's full load current does not exceed the maximum continuous output current rating of the drive. When the motor full load current does exceed the maximum continuous output rating of the AC drive, a larger one must be selected.

In multi-motor applications the sum of the motor full load current, not horsepower must be used to select the appropriate AC drive.

Ambient Temperature/Altitude

The AC Drive and connected motor is rated to operate in an ambient temperature of 0-40 °C (32-104 °F), and deliver full rated horsepower nameplate data. When ambient temperatures exceed the 40 °C (104 °F) operational ambient environment, both the AC drive and motor must be derated. For installations that require a higher operating ambient, derate by one horsepower size to a maximum of 50°C (122 °F).

The ALTIVAR AC drives are also rated for up to 3,300 feet (1,000 meters) altitude without derating. Above these ratings, the AC drive must be derated by 1.2% for every 300 feet (100 meters) up to a maximum of 6,600 feet (2,000 meters). For conditions where altitude exceeds 6,600 feet, special considerations apply. Environment, application, loading, and ambient operating conditions could extend altitude range.

AC Line & Motor Voltage

The Class 8839 ALTIVAR enclosed AC drives are designed for operation under continuous rated input power from 208 V, 230 V and 460 V line voltages, ± 10% at 50/60 Hz. The selection tables list the horsepowers available at the different voltage ratings. Alternate line voltage configurations are also available on a special order basis. Consult the Drives Applications Group for those applications.

Normally, input voltage and motor voltage will be the same, however, certain applications requiring constant torque above 60 Hz base speed will involve connecting the AC drive to a 460 V supply and connecting the motor for 230 V at 60 Hz. The AC drive can be adjusted to provide 230 V out at 60 Hz and 460 V out at 120 Hz. If this mode of operation is desired, the AC drive must be selected based on the full load current at 230 V.

Power Factor

The ALTIVAR AC drive uses diode bridge rectifiers which converts the fixed voltage and frequency from the AC line to a fixed DC bus voltage. Operation of the rectifiers does not cause any additional displacement between the voltage and current on the AC line feeding the AC drive.

This means that the displacement power factor (power factor measured by the utility) will not be degraded. Therefore, the AC drive power factor is rated 0.95 or better (lagging) at all times.

Harmonics

Concerning the subject of harmonics, all types of adjustable speed drives using power semiconductors and switching power supplies will produce harmonic currents, which will cause a non-sinusoidal voltage in the power system. The suggested guidelines for voltage and current distortion are addressed in IEEE Standard 519-1992 titled "IEEE Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems", which suggests distortion limits dependent upon the electric power distribution system for industrial and commercial consumers.

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Collectively, all facility loads and the building electrical distribution network determines the harmonic levels at the user & electric utility interface. Commonly misapplied, the Electrical Power Research Institute (EPRI) recognizes the 'Point of Common Coupling' or PCC as the interface between user and electric utility (energy meter) in the electrical distribution network. This position will also be supported in the forthcoming Application Guide (P519A) being prepared by the Harmonics Working Group of IEEE. Square D Company will typically provide 'drive isolation transformers' or 'line reactors' as the most cost effective method of harmonic abatement.

For specifications that are regulated by utilities to the IEEE 519 guidelines, there are alternate methods of harmonic abatement that can be suggested such as phase shifting transformer, 12-pulse designs and Broad-Band harmonic filters but are not included within this catalog. Consult the Drives Applications Group for configurations and pricing.

Input Currents Ratings (with and without Line Reactor)

Square D publishes input currents based on distribution system impedance at various available fault current ratings. Our literature reflects multiple input current ratings based on available fault currents

- 5,000 AIC (1-50 hp) or 10,000 AIC (60-200 hp) or 18,000 AIC (250-400 hp) and
- 22,000 AIC and
- 65,000 AIC

More common, line reactors are provided with the majority of AC Drives today. The reasons proliferate from abnormal line conditions, IEEE 519 guidelines, to power quality concerns. Line reactors provide the most cost effective option to minimize harmonic currents reflected back into the distribution system. The use of line reactance ahead of the AC drive will function best to:

1. Reduce line current harmonic injection into the primary source, limiting the input ‘rms’ currents to less than or equal to motor full load amps.
2. Reduce the available feeder short circuit capacity.
3. Meet specified line impedance requirements.

A supplemental nameplate for all Class 8839 products now contains input current ratings for both 3% and 5% rated line reactors. By listing the alternate input currents when using a series minimum line reactor rating, the user could benefit in savings reflected in conductor and disconnect selection, as required by the National Electric Code.

Drive Isolation Transformer

Drive Isolation transformers are designed for maximum benefit when applied to an AC drive. In addition to the functional comparison of a line reactor, drive isolation transformers are normally used for one of the following reasons over a standard line reactor:

1. Match system voltage to drive rating.
2. Meet local or plant codes that require isolation.
3. Capable of correcting line voltage unbalance conditions commonly seen with open delta and corner grounded delta distribution systems.
4. Provides continuity of service for nuisance grounding.
5. Reduces drive induced currents in supply feeder ground and limit ground fault currents.
6. Isolate the electrical common mode noise generated in solid state controllers from the distribution system.

The ALTIVAR AC drive uses a diode bridge input stage which does not produce the electrical switching transients common to converters using SCRs such as DC drives. The enclosed ALTIVAR AC drives have a high fault withstand capability (up to 65,000 A depending upon configuration). For these reasons, Square D does not suggest the use of a drive isolation transformer for isolation purposes unless the system requires one or more of the six functions listed above.

Speed Range & Regulation

The ALTIVAR 66 AC drives will operate within the range of 0.1 to 400 Hz (up to 125 hp constant torque) or 0.1 to 200 Hz (150 hp and 200 hp constant torque) or 0.1 to 60/72 Hz (for variable torque) and is dependent upon unit configuration. Please note, if operating motors above base speed, the motor manufacturer must approve operation for the specified speed range. The ALTIVAR 56 AC drive will operate within the range of 0.1 to 60/72 Hz configurations optimized for variable torque applications only.

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Speed regulation is determined by one of several modes of configuration. Most AC drives utilize the volts/hertz mode where speed regulation is determined by the motor slip, typically 3% or less. The ALTIVAR AC drive utilizes sensorless flux vector mode (SLFV) as standard with 1% speed regulation; with optional tachometer can be improved to 0.5%.

Accelerating Torque

AC induction motors built to NEMA standards are designed to provide starting torque which must meet certain minimum ratings. This is normally expressed as a percentage of full load torque. These torque ratings are valid only for full voltage starting where inrush current can be approximately 600% of motor full load current. The ALTIVAR AC Drive will limit starting current to a value of usually not more than 150% (CT rated)) to 110% (VT rated) of drive full load current, which provides approximately 150% starting torque for CT loads and 110% for VT loads.

AC Drives provide better torque per ampere than any other reduced inrush method, but the starting torque available may be less than the starting torque available with an across-the-line starter. Applications with known high starting torque requirements should be carefully evaluated. It may be necessary to oversize the AC Drive, or the motor to provide the necessary accelerating torque.

Dynamic Braking

Dynamic braking directs the regenerative energy from an AC induction motor dissipated in the form of heat through a resistor. This condition presents an electrical load, or retarding torque, to the motor, which is acting as a generator. The thermal capacity required for this resistor is determined by the stopping duty cycle for the load and the energy dissipated for each deceleration.

Dynamic braking requires the motor to remain energized to maintain the rotating magnetic field. Dynamic braking cannot operate during periods where power is lost and cannot maintain holding torque when the AC Drive is stopped. A mechanical brake must be used when the application requires a holding torque at zero speed.

A dynamic braking resistor configuration is available as optional equipment. The dynamic braking resistor is sized to be capable of absorbing six times the stored energy of a motor at maximum speed, which means it could make 6 consecutive stops from rated speed without overheating. Applications with high inertia are typical candidates for dynamic braking.

Follower Signals

The ALTIVAR series of AC drives are designed to accept either a 0-10 Vdc, 4-20 mAdc, or 3-15 psig (by option) analog input. Other follower signals may be accommodated which will require additional hardware or signal conditioners as optional equipment.

PI Regulator

The ALTIVAR AC Drive has a build in PI regulator to provide set-point control from the key pad or remote analog signal. Selection parameters are set via the key pad to automatically control a level, pressure or flow process. This PI function does not require any additional hardware, such as options boards or separately mounted equipment.

Bypass Operation

Although the Class 8839 ALTIVAR AC drive is designed for maximum reliability, it is possible that a controller could be out of service when required to operate. Critical operations which can tolerate little or no down time should be considered as candidates for bypass (full speed) operation.

This involves an isolation contactor to disconnect the motor from the AC Drive and a full voltage starter to bypass the controller and operate the motor across-the-line or by an alternate starter such as a reduced voltage autotransformer starter or a solid state reduced voltage starter.

Motor Selection

ALTIVAR AC drives are designed to operate with any three phase AC squirrel cage induction motor or synchronous reluctance motor having voltage and current ratings compatible with the drive.

It is recommended that all motors used with AC Drives be equipped with thermostats in the stator windings. This affords the ultimate motor overload protection much better protection than overload devices sensitive to motor current, because motor temperature may rise due to loss of cooling resulting from low speed operation and not necessarily because of an overcurrent condition.

The motor should meet NEMA MG-1, Part 31 standards. This motor spec calls for 1600 volt rated magnet wire, while the NEMA MG-1, Part 30 standard calls for 1000 volt rated magnet wire. The higher voltage rated magnet wire will protect against possible premature motor failures due to voltage stress from fast dv/dt rise times commonly seen with IGBT based AC Drives.

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Enclosure Types

The Class 8839 ALTIVAR Enclosed AC Drives are available in Type 1 or Type 12 enclosures. If Type 3R, 4 or 4X enclosures are required, consult the Drives Applications Group.

Outside installations requiring drives should be quoted for installation in climate controlled Type 3R walk-in enclosures available separately from our Power Zone Center group in Smyrna, TN.

Relay Contact Ratings

Relay contacts are available for customer use. The maximum inductive load ratings of 120 Vac, 2A inductive, 220 Vac, 1 A inductive or 24 Vdc, 2 A inductive - normally open, normally closed contacts for the annunciation of drive fault (R1 relay) and run (R2 relay - programmable) conditions. With the use of the I/O extension module, there are (2) additional relay contacts (R3 and R4 relays - programmable) available for customer use.

Environment

Conformance to standards		UL, CUL, CSA, and IEC UL File 105655 CCN NMMS CSA File LR 584 Class 3211 06 & 3211 86 Conforms to ISO 9001 standards and NEC
Degree of protection		Type 1 (IP30), and Type 12 (IP54)
Maximum ambient pollution		Pollution degree 3 per NEMA ICS-111A and IEC 664-1
Maximum relative humidity		95% without condensing or dripping
Temperature Storage Operation	°F (°C)	-13 to +158 (-25 to +70) +32 to +104 (0 to +40)
Maximum altitude	ft (m)	3300 (1000) without derating For each additional 300 (100), derate by 1.2%, maximum 6600 (2000)
Mounting position		Vertical

Drive Characteristics

Output frequency range	Hz	0.1 to 400 for ATV66U41N4 to C13N4 drives (constant torque configuration) 0.1 to 200 for ATV66C15N4 to C19N4 drives (constant torque configuration) 0.1 to 60/72 for ATV66U41N4 to C19N4 drives (variable torque configuration)
Speed range		1 to 100 (with constant torque)
Maximum transient current		200% of nominal motor current for 0.2 s at starting for constant torque configuration 150% of nominal motor current for 60 s for constant torque configuration 110% of nominal motor current for 60 s for variable torque configuration

Electrical Characteristics

Input	Voltage Frequency	V Hz	460 ±10% 60 ±2%
Available control voltage			3 outputs: 0 V common for all supplies 1 output: +10 V for the reference potentiometer (2.2-2.5 kΩ),10 mA maximum flow 1 output: +24 V for control inputs, 210 mA maximum flow
Analog inputs AI Speed reference			1 analog voltage input AI1: 0-10 V, impedance 30 kΩ 1 analog current input AI2: 4-20 mA, impedance 250 Ω AI2 can be modified to 0-5 V with a switch located on the control board or reprogrammed from the keypad display for 0-20 mA, x-20 mA or 20-4 mA. Frequency resolution: 0.1 Hz at 60 Hz for analog reference Response time: 5 to 10 ms
Frequency resolution for digital reference (serial link)			0.015 Hz at 60 Hz
Acceleration and deceleration ramps			Factory preset to 3 s, linear Separately adjustable from 0.1 to 999.9 s (0.1 s resolution) Ramp type: adjustable to linear, “S”, or “U” Ramp times automatically adjusted in case of overtorque
Braking to standstill			Automatic by DC injection for 0.5 s when frequency drops below 0.1 Hz Amount of current, frequency threshold and injection time are programmable from the keypad display
Converter Protection			Protection against short circuit, Class T fuse Between the output phases Between output phases and ground On internal supply outputs On the logic and analog outputs Thermal protection against excessive overheating Protection against input line supply undervoltage and overvoltage Protection against phase loss
Motor protection			Incorporated electronic thermal protection by I^2t calculation taking speed into account Storage of motor thermal state Function programmable from the keypad display

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Note:

These specifications are for Enclosed Adjustable Frequency Drive Controllers or herein referred to as AC Drives. The Power Converter is a component of the AC Drive. The Construction Specifications Institute (CSI) format has been conformed with for project compatibility.

Application information directly affects the type and rating of AC Drive that will be quoted. Brackets{ } are provided where such data should be included.

Please call your local Square D distributor or sales representative for specification assistance regarding a particular application.

The AC Drive specification should be included in Division 16, Electrical for proper coordination with the electrical distribution system.

PART 1: GENERAL

1.01
Scope of work

a. This section provides specification requirements for adjustable frequency drives, variable speed drives or herein identified as AC Drives for use with {NEMA B, NEMA D, NEMA A, NEMA E, Wound Rotor, Synchronous} design AC motors.
b. The AC Drive manufacturer shall furnish, field test, adjust and certify all installed AC Drives for satisfactory operation.
c. Any exceptions/deviations to this specification shall be indicated in writing and submitted with the quotation.

1.02
References

a. ANSI/NFPA 70 - National Electrical Code
b. ANSI C84.1 - Voltages Tolerances for North America
c. CSA C22.2 No. 14-M91 - Industrial Control Equipment
d. IEC 68 Part 2-3 - Basic Environmental Testing Procedures Part 2: tests - Test Ca: Damp Heat
e. IEC 146.1 - Semiconductor Converters-General Requirements and Line Commutated Converters Part 1-1: Specifications of Basic Requirements
f. IEC 664 - Insulation Coordination for Equipment Within Low-Voltage Systems
g. IEC 447 - Man-Machine Interface Actuating Principles
h. IEC 439 Part 1 - Low Voltage Switchgear and Controlgear Assemblies
i. IEC 947 - Low Voltage Switchgear and Controlgear Components
j. IEC 364 - Electrical Installation of Buildings
k. IEC 204/NFPA 79 - Electrical Equipment of Industrial Machines/Industrial Machinery
l. IEC 106 - Guide for Specifying Environmental Conditions for Equipment Performance Rating
m. IEC 529 - Degrees of Protection Provided by Enclosure
n. IEC 1000 - Electromagnetic Compatibility
o. IEC 721 - Classification of Environmental Conditions
p. IEC 255-8 Overload Relays
q. IEC 801-2,-3,-4,-5 - Immunity Tests
r. NEMA ICS 6 - Industrial Control and Systems Enclosures
s. NEMA ICS, Part 4 Overload Relays
t. NEMA 250 Enclosures for Electrical Equipment
u. NEMA ICS 2-321 - Electrical Interlocks
v. NEMA ICS7 - Industrial Control and Systems Adjustable Speed Drives
w. NEMA ICS 7.1 - Safety Standards for Construction and Guide for Selection Installation and Operation of Adjustable Speed Drives
x. UL 50 - UL Standard for Safety Enclosures for Electrical Equipment
y. UL 98 - UL Standard for Disconnect Switches
z. UL 507 - UL Standard for Safety Electric Fans
aa. UL 508 - UL Standard for Safety Industrial Control Equipment
ab. UL 508C - UL Standard for Safety Power Conversion Equipment
ac. UL 991 - UL Standard for Safety Tests for Safety Related Controls employing Solid State Devices
ad. OSHA 1910.95 - AC Drive Controller Acoustical Noise
ae. Conforming to National Safe Transmit Association and International Safe Transmit Association Test for Packages Weighing 100 lbs or Over.

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1.03
Submittals

a. {6} - copies of approval drawings shall be furnished for Engineer's approval prior to factory assembly of the AC Drives. These drawings shall consist of elementary power and control wiring diagrams and enclosure outline drawings. The enclosure drawings shall include front and side views of the enclosures with overall dimensions and weights shown, conduit entrance locations and nameplate legends.
b. Standard catalog sheets showing voltage, horsepower, maximum current ratings and recommended replacement parts with part numbers shall be furnished for each different Horsepower rated AC Drive provided.

1.04
Warranty

a. 18 months parts warranty shall be provided on materials and workmanship from the date of invoice.

1.05
Quality Assurance

a. The manufacturer of the AC Drive shall be a certified ISO 9001 facility.
b. The AC Drive and all associated optional equipment shall be UL listed according to Power Conversation Equipment UL 508C. A UL label shall be attached inside each enclosure as verification.
c. The AC Drive shall be designed, constructed and tested in accordance with NEMA, NEC, VDE, IEC standards and CSA certified.
d. Every Power Converter shall be tested with an actual AC Induction Motor 100% loaded and temperature cycled within an environment chamber at 104 degrees. Documentation shall be furnished to verify successful completion at the request of the engineer.
e. All Drive door mounted pilot devices shall be tested to verify successful operation. Documentation shall be furnished upon the request of the engineer.
f. The AC Drive shall be submitted to a Hi-Pot test with all enclosed devices mounted and wired, prior to shipment.

PART 2: PRODUCT

2.01
Manufacturers

a. The AC Drive shall be provided by Square D Company, Class 8839, Type ATV66, or prior approved equal. Substitutions must be submitted in writing three weeks prior to original bid date with supporting documentation demonstrating that the alternative manufacturer meets all aspects of the specifications herein.
b. Alternate control techniques other than pulse width modulated (PWM) are not acceptable.

2.02
General Description

a. The AC Drive shall convert the input AC mains power to an adjustable frequency and voltage as defined in the following sections.
b. The input power section shall utilize a full wave bridge design incorporating diode rectifiers. The diode rectifiers shall convert fixed voltage and frequency, AC line power to fixed DC voltage. This power section shall be insensitive to phase rotation of the AC line.
c. The DC bus shall have external connections for standby battery back-up or for linking multiple, AC Drives DC buses for management of regeneration power.
d. The output power section shall change fixed DC voltage to adjustable frequency AC voltage. This section shall utilize insulated gate bipolar transistors (IGBTs) or intelligent power modules (IPMs) as required by the current rating of the motor.

2.03
Construction

a. The AC Drive shall be mounted in a {Type 1, Type 12} enclosure {with, without} an external operated disconnect device.
b. A mechanical interlock shall prevent an operator from opening the AC Drive door when the disconnect is in the *on* position. Another mechanical interlock shall prevent an operator from placing the disconnect in the *on* position while the AC Drive door is open. It shall be possible for authorized personnel to defeat these interlocks.
c. Provisions shall be provided for locking all disconnects in the *off* position with up to three padlocks.

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d. Current limiting fuses shall be installed and wired to the AC Drive input.
e. Provisions shall be made for accepting a padlock to lock the enclosure door

2.04
Motor Data

a. The AC Drive shall be sized to operate the following AC motor:
   — Motor Horsepower { }
   — Motor full load ampere { }
   — Motor RPM {3600/3000,1800/1500,1200/1000,900/750,720/600,600/500}(60/50 Hz)
   — Motor voltage {200,230,380,415,460}
   — Motor service factor {1.0,1.15,1.25}

2.05
Application Data

a. The AC Drive shall be sized to operate a {Variable Torque, Variable Torque Low Noise, Constant Torque, Constant Horsepower, Impact} load.
b. The speed range shall be from a minimum speed of 0.5 Hz to a maximum speed of 400 Hz.

2.06
Environmental Ratings

a. The AC Drive shall be of construction that allows operation in a pollution Degree 3 environment. The AC Drive shall meet IEC 664-1 and NEMA ICS 1 Standards. AC Drives that are only rated for Pollution Degree 2 environment shall not be allowed.
b. The AC Drive shall be designed to operate in an ambient temperature from 0 to + 40 degrees C (+32 to 104 degrees F).
c. The storage temperature range shall be -25 to + 70 degrees C.
d. The maximum relative humidity shall be 95% at 40 degrees C, non-condensing.
e. The AC Drive shall be rated to operate at altitudes less than or equal to 3,300 ft (1000 m). For altitudes above 3,300 ft, de-rate the AC Drive by 1.2% for every 300 ft (100m).
f. The AC Drive shall meet the IEC 68-2 Operational vibration specification.

2.07
Ratings

a. The AC Drive shall be designed to operate from an input voltage of 400 ± 15% Vac and 460 ± 15% Vac.
b. The AC Drive shall operate from an input voltage frequency range from 47.5 to 63 Hz.
c. The displacement power factor shall not be less than 0.95 lagging under any speed or load condition.
d. The efficiency of the AC Drive at 100% speed and load shall not be less than 96%.
e. The {constant, variable} torque rated AC Drive overcurrent capacity shall be {150%, 110%} for 1 minute.
f. The output carrier frequency of the AC Drive shall be randomly modulated and selectable at 2, 4, or 10 kHz depending on Drive rating for low noise operation. No AC Drive with an operable carrier frequency above 10 kHz shall be allowed.
g. The output frequency shall be from 0.1 to 400 Hertz for Drives up to 75 hp. At horsepower's above 75 hp, the maximum output frequency will be 200 Hz.
h. The AC Drive will be able to develop rated motor torque at 0.5 Hz (60 Hz base) in a Sensorless Flux Vector mode using a standard induction motor without an encoder feedback signal.

2.08
Protection

a. Upon power-up the AC Drive shall automatically test for valid operation of memory, option module, loss of analog reference input, loss of communication, dynamic brake failure, DC to DC power supply, control power and the pre-charge circuit.
b. The AC Drive shall be UL 508C listed for use on distribution systems with {5,000A or 10,000A RMS, 22,000A RMS, 65,000A RMS} available fault current. The Power Converter shall meet short circuit withstandability of 65,000 RMS symmetrical amperes as defined by NEMA ICS 7.1.09 and have the value listed on the AC Drive nameplate.
c. The Power Converter shall be protected against short circuits, between output phases and ground; and the logic and analog outputs.
d. The AC drive shall have a minimum AC undervoltage power loss ride-through of 200 msec. The AC Drive shall have the user defined option of frequency fold-back to allow motor torque production to continue to increase the duration of the powerloss ride-through.
e. The AC drive shall have a selectable ride through function which will allow the logic to maintain control for a minimum of one second without faulting.

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f. For a fault condition other than a ground fault, short circuit or internal fault, an auto restart function will provide up to 5 programmable restart attempts. The programmable time delay before restart attempts will range from 1 second to 600 seconds.

g. The deceleration mode of the AC drive shall be programmable for normal and fault conditions. The stop modes shall include free-wheel stop, fast stop and DC injection braking.

h. Upon loss of the analog process follower reference signal, the AC drive shall fault and/or operate at a user defined speed set between software programmed low speed and high speed settings.

i. The AC drive shall have solid state I^2t protection that is UL listed and meets UL 508 C as a Class 10 overload protection and meets IEC 947. The minimum adjustment range shall be from 0.45 to 1.05 percent of the current output of the AC Drive.

j. The AC Drive shall have a thermal switch with a user selectable prealarm that will provide a minimum of 60 seconds delay before overtemperature fault.

k. The AC Drive shall utilize bonded fin heatsink construction for maximum heat transfer.

l. The AC drive shall have a programmable fold-back function that will anticipate a controller overload condition and fold back the frequency to avoid a fault condition.

m. The output frequency shall be software enabled to fold back when the motor is overloaded.

n. There shall be 3 skip frequency ranges that can each be programmed with a selectable bandwidth of 2 or 5 Hz. The skip frequencies shall be programmed independently, back to back or overlapping.

o. The AC Drive shall include Metal Oxide Varistors (MOVs) wired to the incoming AC Mains.

2.09
Adjustments and Configurations

a. The AC drive shall self-configure to the main operating supply voltage and frequency. No operator adjustments will be required.

b. Upon power-up, the AC drive will automatically send a signal to the connected motor and store the resulting resistance data into memory. The inductance data will be measured during no-load operation when operating at a frequency between 20-60 Hz. The AC Drive will automatically optimize the operating characteristics according to the stored data.

c. The AC drive will be factory pre-set to operate most common applications.

d. A choice of three types of acceleration and deceleration ramps will be available in the AC Drive software; linear, S curve and U curve.

e. The acceleration and deceleration ramp times shall be adjustable from 0.1 to 999.9 seconds.

f. The volts per frequency ratios shall be user selectable to meet variable torque loads, normal and high torque machine applications.

g. The memory shall retain and record run status and fault type of the past 8 faults.

h. Slip compensation shall be a software enabled function.

i. The software shall have a NOLD (no load) function that will reduce the voltage to the motor when selected for variable torque loads. A constant volts/Hz ratio will be maintained during acceleration. The output voltage will then automatically adjust to meet the torque requirement of the load.

j. The AC drive shall offer programmable DC injection braking that will brake the AC motor by injecting DC current and creating a stationary magnetic pole in the stator. The level of current will be adjustable between 50-150% of rated current and available from 0.0-30 seconds continuously. For continuous operation after 30 seconds, the current shall be automatically reduced to 50% of the nameplate current of the motor.

k. Sequencing logic will coordinate the engage and release thresholds and time delays for the sequencing of the AC Drive output, mechanical actuation and DC injection braking in order to accomplish smooth starting and stopping of a mechanical process.

2.10
Operator Interface

a. The operator interface terminal will offer the modification of AC drive adjustments via a touch keypad. All electrical values, configuration parameters, I/O assignments, application and activity function access, faults, local control, adjustment storage, self-test and diagnostics will be in plain English. There will be a standard selection of 4 additional languages built-in to the operating software as standard.

b. The display will be a high resolution, LCD backlighted screen capable of displaying graphics such as bar graphs as well as six

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lines of twenty-one alphanumeric characters.

c. The AC drive model number, torque type, software revision number, horsepower, output current, motor frequency and motor voltage shall all be listed on the drive identification display as viewed on the LCD display.

d. The display shall be configured to display one or two bargraphs with numeric data that are selectable and scalable by the operator. A user defined label function shall be available. As a minimum the selectable outputs shall consist of speed reference, output frequency, output current, motor torque, output power, output voltage, line voltage, DC voltage, motor thermal state, drive thermal state, elapsed time, motor speed, machine speed reference and machine speed.

e. A single keystroke scrolling function shall allow dynamic switching between display variables.

f. The terminal keypad will consist of programmable function keys. The functions will allow both operating commands and programming options to be preset by the operator. A hardware selector switch will allow the terminal keypad to be locked out from unauthorized personnel.

g. The operator terminal will offer a general menu consisting of parameter setting, I/O map, fault history, and drive configuration. A software lock will limit access to the main menu. The main menu will consist of keypad configuration, drive configuration, general configuration, diagnostic mode and drive initialization screens.

h. There will be arrow keys that will provide the ability to scroll through menus and screens, select or activate functions or increase the value of a selected parameter.

i. A data entry key will allow the user to confirm a selected menu, numeric value or allow selection between multiple choices.

j. An escape key will allow a parameter to return the existing value if adjustment is not required and the value is displayed. The escape function will also return to a previous menu display.

k. A RUN key and a STOP key will command a normal starting and stopping as programmed when the AC drive is in keypad control mode. The STOP key must be active in all control modes.

l. The AC drive shall have 3 LEDs mounted on the front panel to indicate functional status. A green LED will verify that the AC drive power supply is on. A red LED indicator will indicated an AC drive fault. A yellow LED indicator will designate a pending fault condition.

m. The status LEDs shall be able to be remotely mounted up to 3 meters from the AC drive.

n. A user interface shall be available that is a Windows 3.1 based personal computer, serial communication link or detachable operator interface.

o. The Keypad and all door mounted controls must be {Type 1,Type 12} rated.

2.11 Control

a. External pilot devices shall be able to be connected to a terminal strip for starting/ stopping the AC Drive, speed control and displaying operating status. All control inputs and outputs will be software assignable.

b. 2-wire or 3-wire control strategy shall be defined within the software. External relays or logic devices will not be allowed.

c. The control power for the digital inputs and outputs shall be 24 Vdc.

d. The internal power supply incorporates an automatic current fold-back that protects the internal power supply if incorrectly connected or shorted. The transistor logic outputs will be current limited and not be damaged if shorted or excess current is pulled.

e. All logic connections shall be furnished on pull apart terminal strips.

f. There will be 2 software assignable, analog inputs. The analog inputs will be software selectable and consist of the following configurations: 0-20 ma, 4-20 ma, 20-4 ma, x-20 ma (where x is user defined) 0-5 V, 1-5 V or 0-10 V.

g. There will be 4 software assignable, isolated logic inputs that will be selected and assigned in the software. The selection of assignments shall consist of run/reverse, jog, plus/minus speed (2 inputs required), setpoint memory, preset speeds (up to 2 inputs), auto/manual control, controlled stop, terminal or keypad control, by-pass (2 inputs required), motor switching, and fault reset.

h. There will be two software assignable analog outputs that can be selected and assigned in the software. The analog output assignments shall be proportional to the following motor characteristics: frequency, current, power torque, voltage and thermal state. The output signal will be selectable from 0-20 ma or 4-20 ma.

i. Two voltage-free Form C relay output contacts will be provided. One of the contacts will

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indicate AC drive fault status. The other contact will be user assignable.

j. There shall be a hardware input/output extension module which also provides interlocking and sequencing capabilities. The module shall be fully isolated and housed in a finger safe enclosure with pull apart terminal strips. The module will add 4 logic inputs, 2 analog inputs, 2 relay outputs and one analog output. All of the I/O will be user assignable in the software as previously defined.

k. The AC Drive door mounted control island shall include a power ON, Drive RUN, Drive Fault Light and Hand-Off-Auto selector switch with Manual Speed Potentiometer.

l. The AC Drive control island shall accept {% indicating analog, absolete indicating digital} meters to display {Power, Amperes, Voltage, Hertz}.

2.11
Braking (Application Dependent Option)

NOTE: When braking certain types of loads, there is the conversion of kinematic energy into electrical energy by the motor which is returned to the AC drive. Dynamic braking can be chosen to absorb this energy and avoid causing the AC drive to inadvertently shut down. The energy is dissipated across a resistor that is connected to the drive. For constant torque AC drives, the dynamic braking unit must be capable of stopping 1.5 per unit motor torque from base frequency to 0.5 Hz with sensorless flux vector control mode.

Provisions shall be provided to protect the Dynamic Braking Resistor against overload and overcurrent due to DB switch failure. This protection must be resettable without replacement of fuses or other devices.

a. The dynamic brake resistor shall be provided and connect to existing terminals on the AC drive. The resistor shall mount externally to the AC drive enclosure. An Insulated Gate Bi-polar Transistor (IGBT) will be provided in the AC drive to switch excess regenerative energy to the braking resistor. The braking resistor will be of a size calculated to stop 6 times motor inertia at 1.5 per unit motor torque.

2.12
Isolation/Bypass Contactors

{Manual}

a. The AC Drive shall include IEC rated isolation and bypass contactors complete with thermal overload relay, {circuit breaker, molded case switch} disconnect interlocked with the door, control circuit transformer, motor flux decay timer and AFC-OFF-BYPASS switch. The operator shall have full control of the bypass starter by operation of the door mounted selector switch.

{Automatic}

a. The AC Drive shall include IEC rated isolation and bypass contactors complete with thermal overload relay, circuit breaker disconnect interlocked with the door, control circuit transformer, motor flux decay timer and AFC-OFF-BYPASS selector switch. The operator may select for manual bypass by setting the switch in the BYPASS position or automatic bypass by setting the switch in the AFC position. In the AFC position the AC Drive will provide adjustable speed control of the motor under non-fault conditions of the Drive, when the Drive is under a fault condition the bypass contactor will be automatically energized upon Drive shutdown (Drive fault contact operation) to operate the motor on 60 Hz line power.

2.13
Harmonic Analysis

The harmonic distortion at the point of common coupling (PCC) shall be predicted through computer modeling of the distribution system and connected AC drives as specified. The PCC for voltage distortion shall be at the secondary of the 480 V distribution transformer and the PCC for the current distortion shall be at the primary of the 480 V transformer. These harmonic distortion values must not exceed 5% for voltage and those as listed in IEEE 519-1992, table 10.3 for current distortion. If the calculations determine that harmonic distortion values are higher than the voltage and current values specified, the drive manufacturer shall provide either line reactors, isolation transformers, multi-pulse input drives or trap filters to meet the intent of IEEE 519-1992 guidelines. This harmonic analysis report shall be part of the approval drawing process, submitted to the engineer for approval.

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Normal operation is defined as follows:

1. Utility transformer kVA rating {specify kVA rating}
2. Number of drives operating simultaneously: {Specify individual load requirements}
3. Operating speed range: {50 to 100%} speed range
4. Point of common coupling: Load side of transformer (voltage), Line side of transformer (current)

Under emergency operating conditions the harmonic distortion at the point of common coupling (PCC) shall be predicted through computer modeling of the emergency generator system and connected ac drives as specified. The PCC for voltage distortion shall be at the generator load terminals. The harmonic voltage distortion value must not exceed the maximum permissible value specified by the generator manufacturer. The drive manufacturer shall coordinate with the manufacturer of the emergency generator specified in Section 11000 to obtain data for the harmonic analysis. If the calculations determine that harmonic distortion values are higher than the voltage specified, the drive manufacturer shall provide either line reactors, multi-pulse input drives or trap filters to meet the generator manufacturer recommendations.

Emergency operation is defined as follows:

1. Emergency Generator kW rating of: {Specify kW rating}
2. Number of drives operating simultaneously: {Specify individual load requirements}
3. Operating speed range: {50-to 100%} speed range
4. Point of common coupling: Generator terminals

PART 3: EXECUTION

3.01 Inspection

a. Verify that the location is ready to receive work and the dimensions are as indicated.
b. Do not install AC Drive until the building environment can be maintained within the service conditions required by the manufacturer.

3.02 Protection

a. Before and during the installation, the AC Drive equipment shall be protected from site contaminants.

3.03 Installation

a. Installation shall be in compliance with manufacturer's instructions, drawings and recommendations.
b. The AC Drive manufacturer shall provide a factory certified technical representative to supervise the contractor's installation, testing and start-up of the AC drive(s) furnished under this specification for a maximum total of { } days. The start-up service shall be quoted as a separate line item.

3.04 Training

An on-site training course of { } training days shall be provided by a representative of the AC Drive manufacturer to plant and/or maintenance personnel and quoted as a separate line item.

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ALTIVAR 66 Drive Controller Units Sizes 1–4

ALTIVAR 66 Drive Controller Units Sizes 5–7

GENERAL INFORMATION

AC Drives have become common devices to vary the speed of AC motors. Motor control center packaging of AC Drives has become common as more and more applications require accurate control in an integrated solution. Square D provides a flexible AC Drive in the industry's most flexible MCC drive units. Typical applications include pumps, fans, conveyors, mixers and other industrial process machinery. Varying the speed of these applications can provide benefits in energy savings, material flow rates, output quality and process flexibility. The Square D MCC AC Drives integrate a single family of ALTIVAR 66 Drives into a combination drive package for MCCs.

MCC enclosed ALTIVAR 66 AC Drive units are designed for use with standard three-phase asynchronous motors with a power range of 3/4 to 400 hp (variable torque) or 3/4 to 350 hp (constant torque). MCC AC Drive units can be applied to 480 V, three phase, 3-wire or 4-wire systems. The MCC AC Drive units have been designed to provide optimal protection in NEMA/EEMAC Type 1, Type 1 Gasketed (1A), and NEMA/EEMAC Type 12 motor control center enclosures.

BENEFITS OF ALTIVAR 66 AC DRIVES

- Single Family Concept
  - — One control interface design for all ratings
  - — Consistent wiring for any application
  - — Interchangeable spare parts
  - — Common integration approach
- Unprecedented Modularity
  - — Optional I/O upgrades and extensions are easily attached
  - — Plug-apart control terminals allow quick installation/removal
  - — Multi-level programming menus are divided for quick setup
- Clearly Displays Information
  - — 6 line X 21 character graphic LCD display
  - — Selectable bar graph or text display formats of motor and drive information
  - — Fault information in complete statements, not codes
- Adapts to your Requirements
  - — Multiple languages for worldwide acceptance
  - — Keypad or terminal strip control
  - — Scaleable frequency and current to indicated production levels
  - — User assignable function keys
  - — Menus expand as options are added
- Walks you through start-up
  - — User prompt, pull down menus and help screens simplify user configuration
  - — Self-tuning upon power up based on input mains voltage and frequency
  - — Automatic motor sensing and modeling at start-up for self-tuning sensorless flux vector control
  - — Help screens are available to answer start up questions quickly
- Monitoring and Communication Capability
  - — Credit card style PCMCIA option cards support various serial communication protocols including MODBUS Plus
  - — Fault history for eight occurrences can help diagnose system events.
  - — Auto-diagnostic and logic test routines communicate drive conditions for maintenance

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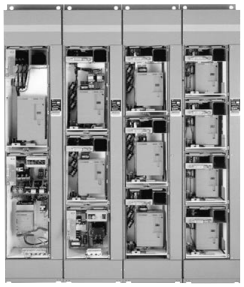


ALTIVAR Lineup with Doors Open

MCC PACKAGING

ALTIVAR AC Drives installed in Square D MCCs are designed for harsh industrial environments in order to promote long term reliability. Several key features of the package design make Square D AC Drive units more suitable for MCC installations. MCC AC Drive units are plug-on style saddle units up to 50 hp variable torque. Units above 50 hp variable torque are mounted in full height sections of varying width and depth. There are no placement limitations for mounting any AC drive or multiple AC Drives in an MCC section.

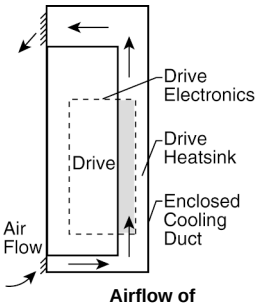
Drive units are designed to incorporate standard features of Model 6 MCC units such as:

- white interiors for greater visibility in maintenance
- cast metal handle disconnect for ruggedness
- twin-handle cam racking mechanism for easy installation/removal
- Unit nameplates are supplied as standard.
- Vertical and horizontal wireways are left undisturbed by drive unit.

NEMA/EEMAC Type 12 MCC ALTIVAR AC Drive Lineup

The thermal management system included in NEMA/EEMAC Type 1 or 1A (Gasketed) AC Drive units consists of a closed duct system to separate outside air from electrical components. AC Drives give off a large mount of heat relative to other electro-mechanical devices in the MCC. This heat must be removed from the MCC and AC Drive in order to maintain temperature rise limits. The duct system included with MCC ALTIVAR 66 AC Drive units removes heat to allow maximum density and does not allow outside air to contaminate the electronics or other MCC units.

The thermal management system provides superior protection for the AC Drive even in the dirtiest NEMA/EEMAC Type 1 environments. The system is self-powered and includes overtemperature protection to shutdown the drive in case of fan or duct blockage. Inlet and outlet ducts allow airflow across the metal heatsink fins of the AC Drive as shown in the Airflow figure.



Airflow of NEMA/EEMAC Type 1 or 1A (Gasketed) AC Drive Unit

The NEMA/EEMAC Type 12 MCC ALTIVAR 66 AC Drive thermal management systems differ from the systems used in NEMA/EEMAC Type 1/1A (Gasketed). NEMA/EEMAC 12 units are totally enclosed, non-ventilated (TENV) up to 20 hp. The TENV design provides increased integrity and does not allow air flow across the AC Drive heatsinks. Units rated at 3/4–5 hp are totally enclosed and include an internal stirring fan. Units rated at 7.5–20 hp use a door mounted heat exchanger and include an internal stirring fan. Contaminants are not allowed inside the units for environments where oil, dust, or other build-up may occur. Units rated above 20 hp incorporate a closed duct cooling system similar to NEMA/EEMAC Type 1/1A (Gasketed).

All ALTIVAR MCC AC Drive units include a door mounted graphical interface with a keypad. Operator adjustments can be made and diagnostics can be viewed without having to go inside an energized unit. A control operator station is also included on the door of each unit for the addition of a wide range of pilot lights, pushbuttons, selector switches and meters. Up to eight pilot devices or four pilot devices and 2 meters can be mounted on the control station. LEDs are brought out to the door to indicate the drive power is on, the drive is in an alarm condition or the drive is in a fault condition.

Each MCC AC Drive unit goes through complete assembly and test procedures at the MCC facility. The MCC facility is registered to ISO 9001. UL 845 Motor Control Center standards are used to list each MCC drive unit in the product offering. The unit UL 845 label and the structure UL 845 label are attached at the MCC factory to maintain a completely UL listed MCC. The MCC factory provides a fully integrated package, which is tested with an actual motor load before shipment. All conductors, disconnects, fusing, lugs and other electrical components are designed per MCC standards as well as NEC 430-2 requirements for AC Drive input currents.

All ALTIVAR MCC AC Drive units are UL 845 listed for a 65,000 A short circuit rating at 480 V. To accomplish this rating, current limiting fuses are installed on the input to each AC Drive. Fuses have a 200,000 A RMS symmetrical interrupting rating. Both circuit breaker and fusible switch units have the necessary current limiting fuses factory installed.

ALTIVAR MCC AC Drive units can be selected with circuit breaker input disconnect or fusible switch input disconnects. Circuit breakers used in the basic drive units are MAG-GARD® magnetic only types up to 200 hp. Fusible switches used in the basic drive units are switches with a separate fuseblock to accommodate the current limiting fuses. Above 200 hp both circuit breaker and fusible switch units use an automatic molded case switch as the input disconnect.

Several standardized power contactor options and control device options are listed on the following pages. Each option is fully tested and documented at the MCC factory. Pilot devices interface with 24 Vdc control as standard. LED

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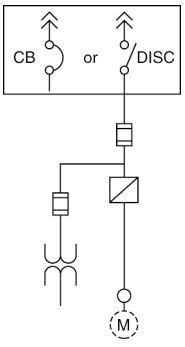
type pilot lights are used with the AC Drive. Optional bypass controls use 120 Vac controls and transformer type pilot lights. All pilot devices are 22 mm Telemecanique components. The MCC factory can also customize MCC ALTIVAR 66 AC Drive units for virtually any application. Contact your local Square D field office for requirements not listed in this catalog.

SELECTION

1. Select all drives based on motor full load amperes. Horsepower is provided for convenience only.
2. Select the drive based on application (torque) type i.e. variable torque, constant torque or variable torque, low noise. The drive will be factory programmed for the selected application type. If you need assistance in qualifying your opportunity or reviewing specifications and drawings, application support for this product can be obtained by contacting your local Square D field office.
3. The ALTIVAR MCC AC Drive includes a basic power circuit consisting of an input disconnect, current limiting fuses and drive controller. Select any optional contactors required for the application by referring to “Power Contactor Options.”
4. Select any control circuit devices by referring to “Pilot Devices.”
5. Select any miscellaneous features such as line reactors or extra control VA by referring to “Miscellaneous Options.”



Power Circuit for “Basic” Drive

“BASIC” DRIVE POWER CIRCUIT

- Consist of disconnect switch and Drive pre-programmed for Variable Torque, Variable Torque Low Noise or Constant Torque application.
- Includes current limiting power fuses.
- Unit is UL 845 Listed for 65,000 A Short Circuit Current.
- Drive keypad and LEDs are door mounted.
- Includes door mounted operator control island with up to eight spaces for user specified 22mm Telemecanique XB2 pilot devices.
- Control power transformer (480 V/120 V) for enclosure ventilation fans is included.

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Variable Torque ALTIVAR 66 and 56 Drives with Circuit Breaker/Fusible Switch Disconnects
Nominal horsepower shown for convenience only. Size per actual motor full load amperes.

Motor Rated Horsepower at 460 V	Max. Cont. Output Amps	NEMA Type 1 and 1A (Gasketed) Space	NEMA Type 12 Space
3/4–5	7.6	18"	24"
7.5	11	18"	36"
10	14	24"	
15	21	24"	
20	27	36"	
25	34	36"	45"
40	52	45"	
50	65	45"	72" (25"W)
75	96	72" (25"W)	
100	124	72" (25"W)	72" (35"W x 20"D)
125 200	156 240	72" (35"W x 20"D)	
400	477	72" (40"W x 20"D)	Not Available

Constant Torque ALTIVAR 66 Drives with Circuit Breaker or Fusible Switch Disconnects
Nominal horsepower shown for convenience only. Size per actual motor full load amperes.

Motor Rated Horsepower @ 460 V	Max. Cont. Output Amps	NEMA Type 1 and 1A (Gasketed) Space	NEMA Type 12 Space
3/4–5	7.6	18"	24"
10	14	24"	36"
20	27	36"	36"
40	52	45"	45"
75	96	72" (25"W)	72" (25"W)
200	240	72" (35"W x 20"D)	72" (35"W x 20"D)
350	420	72" (40"W x 20"D)	Not Available

Low Noise Variable Torque ALTIVAR 66 and ALTIVAR 56 Drives with Circuit Breaker or Fusible Switch Disconnects
Nominal horsepower shown for convenience only. Size per actual motor full load amperes.

Motor Rated Horsepower @ 460 V	Max. Cont. Output Amps	NEMA Type 1 and 1A (Gasketed) Space	NEMA Type 12 Space
3/4–5	7.6	18"	24"
10	14	24"	36"
20	27	36"	36"
40	52	45"	45"
75	96	72" (25"W)	72" (25"W)

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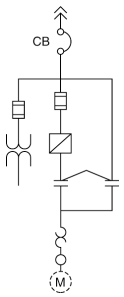
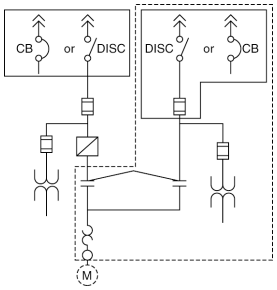
Power Contactor Options (only 1 allowed)

Power Circuit Diagram					
Description			**Integrated Bypass** (Available with Circuit Breaker Disconnect only. Uses Telemecanique contactors.)	**Barriered Bypass** (Uses NEMA contactors)	**Barriered Application Rated COMPAC™ 6 Bypass** (14 A max.)
Power Circuit Type①			**C**②	**U**③	**E**③
Variable Torque	Variable Torque Low Noise	Constant Torque	Space Adder	Space Adder	Space Adder
3/4–5 hp	3/4–5 hp	3/4–5 hp	9"(NEMA 1)/3"(NEMA 12)	18"	6"
7.5 hp	—	—	9"(NEMA 1)/0"(NEMA 12)	18"	6"
10 hp	7.5–10 hp	7.5–10 hp	6"(NEMA 1)/0"(NEMA 12)	18"	6"
15 hp	—	—	6"(NEMA 1)/9"(NEMA 12)	18"	N/A
20–25 hp	15–20 hp	15–20 hp	3"(NEMA 1)/9"(NEMA12)	18"	N/A
—	25 hp	25 hp	9"(NEMA 1/12)	18"	N/A
30–40 hp	30–40 hp	30–40 hp	9"(NEMA 1/12)	27"	N/A
50 hp	—	—	9"(NEMA 1)/5" added to width (NEMA 12)	27"	N/A
—	50 hp	50 hp	5" added to width (NEMA 1/12)	27" in adjacent section	N/A
60–100 hp	60–75 hp	60–75 hp	5" added to width (NEMA 1/12)	33" in adjacent section for CB. 39" in adjacent section for FS.	N/A
—	—	100 hp	20" added to width (NEMA 1/12)	33" in adjacent section for CB.39" in adjacent section for FS.	N/A
125–150 hp	—	125 hp–150 hp	20" added to width (NEMA 1/12)	25" added to width	N/A
200 hp	—	200 hp	20" added to width (NEMA 1/12)	25" added to width	N/A

① For Power Contactor Options above 200 hp contact the Square D Field Office.

②
- Basic Drive features with isolation and bypass contactors for emergency full speed operation in same compartment.
- Telemecanique D or F line contactors are used.
- Only available as Circuit Breaker disconnect common to drive and bypass.
- Drive and bypass are UL 845 Listed for 65,000 A Short Circuit Current and coordinated for Type 1 protection.
- Includes AFC-Off-Bypass selector switch, Red Push-To-Test "AFC" Pilot Light and Yellow Push-To-Test "Bypass" Pilot Light on bypass control island.
- Best use of space with bypass
- Approximately 1/2 the cost of Barriered Bypass

③
- Basic Drive features with isolation and bypass contactors for emergency full speed operation.
- Barriered Application Rated COMPAC™ 6 Bypass uses Telemecanique contactors. NEMA contactors are used on barriered NEMA bypass.
- Separate disconnect for drive and bypass can be operated independently
- Drive and bypass starter are enclosed in compartments separated by metal barriers.
- Drive and bypass are UL 845 Listed for 65,000 A Short Circuit Current and coordinated for Type 1 protection.
- Includes AFC-Off-Bypass selector switch, Red Push-To-Test "AFC" Pilot Light and Yellow Push-To-Test "Bypass" Pilot Light on bypass control island. (Non-Push-To-Test used on COMPAC 6)

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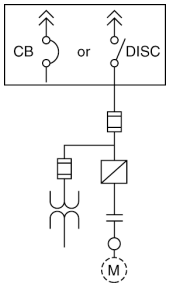
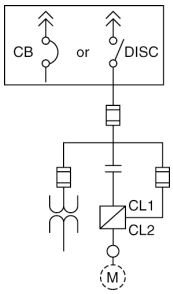
Power Contactor Options (only 1 allowed)

Power Circuit Diagram				
Description			Output Contactor	Input Contactor
Power Circuit Type①			G②	H③
Variable Torque	Variable Torque Low Noise	Constant Torque	Space Adder	Space Adder
3/4–5 hp	3/4–5 hp	3/4–5 hp	9"(NEMA 1)/3"(NEMA 12)	9"(NEMA 1)/3"(NEMA 12)
7.5 hp	—	—	9"(NEMA 1)/0"(NEMA 12)	9"(NEMA 1)/0"(NEMA 12)
10 hp	7.5–10 hp	7.5–10 hp	6"(NEMA 1)/0"(NEMA 12)	6"(NEMA 1)/0"(NEMA 12)
15 hp	—	—	6"(NEMA 1)/9"(NEMA 12)	6"(NEMA 1)/9"(NEMA 12)
20–25 hp	15–20 hp	15–20 hp	3"(NEMA 1)/9"(NEMA12)	3"(NEMA 1)/9"(NEMA12)
—	25 hp	25 hp	9"(NEMA 1/12)	9"(NEMA 1/12)
30–40 hp	30–40 hp	30–40 hp	9"(NEMA 1/12)	9"(NEMA 1/12)
50 hp	—	—	9"(NEMA 1)/ 5" added to width (NEMA 12)	9"(NEMA 1)/ 5" added to width (NEMA 12)
—	50 hp	50 hp	5" added to width (NEMA 1/12)	5" added to width (NEMA 1/12)
60–100 hp	60–75 hp	60–75 hp	5" added to width (NEMA 1/12)	5" added to width (NEMA 1/12)
—	—	100 hp	0"(NEMA 1/12)	0"(NEMA 1/12)
125–150 hp	—	125–150 hp	0"(NEMA 1/12)	0"(NEMA 1/12)
200 hp	—	200 hp	0"(NEMA 1/12)	0"(NEMA 1/12)

① For Power Contactor Options above 200 hp contact the Square D Field Office.

②
- Basic Drive features with output contactor for motor isolation. Contactor is open when drive is not running.
- Telemecanique D or F line contactors are used.
- Drive and output contactor are UL845 Listed for 65,000 A Short Circuit Current.

③
- Basic Drive features with input contactor for isolating drive from input line.
- Allows auto diagnostic routine to be performed without wire changes.
- Telemecanique D or F line contactors are used.
- Drive and output contactor are UL845 Listed for 65,000 A Short Circuit Current.

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Drive Pilot Devices
Hand-Off-Auto Selector Switch and Manual Speed Potentiometer
Start-Stop Pushbuttons and Manual Speed Potentiometer
Stop-Forward-Reverse Push Buttons and Manual Speed Potentiometer
Stop-Run Selector Switch and Manual Speed Potentiometer
Forward-Off-Reverse Selector Switch and Manual Speed Potentiometer
Hand-Auto Selector Switch, Start-Stop Push Buttons, and Manual Speed Potentiometer
Special Purpose Pilot Devices (choose one)
Run-Jog Selector Switch
Jog Push Button
Jog Forward-Jog Reverse Push Buttons
Fast Stop Push Button
Forward-Reverse Selector Switch
Pilot Lights (Push-To-Test or Non-Push-To-Test)
Red “Power On” Light
Red “Run” Light
Green “Run” Light
Red “Stopped” Light
Green “Stopped” Light
Red “Jog” Light
Red “Forward” and “Reverse” Lights
Yellow “Fault” Light
Yellow “Fault” Light with integral Reset Push Button
Yellow “Hand” and “Auto” Lights
Green “Jog” Light
Green “Forward” and “Reverse” Lights
Wire Labels
Metering Options
Analog Speed, 0–120%
Analog Output, Current, 0–200%
Analog Output Volts, 0–150%
Analog Output Power, 0–150%
Digital Speed, 0–120%
Digital Output, Current, 0–200%
Digital Percent Volt
Digital Percent Power

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Miscellaneous Options	Space Adder
Line Reactors (3% Impedance) Each line reactor is mounted in the MCC cabinet as a separate unit above the drive unit and is factory wired to the line side of the drive. Not available on NEMA/EEMAC Type 12 MCCs or drive units above 200 hp.	
1–5 hp, 480 V	9"
7.5–40 hp, 480 V	12"
50 hp, 480 V, Variable Torque only	15"
50 hp, 480 V, Constant Torque or Variable Torque Low Noise only	
60–75 hp, 480 V	
100 hp, 480 V,	
125–150 hp, 480 V	
200 hp, 480 V	0"
100 VA Customer Capacity on Drive's 120 V Control Transformer	
1–20 hp, 480 V, All Types	
25 hp, 480 V, Variable Torque	
300 VA Customer Capacity on Drive's 120 V Control Transformer	
25–40 hp, 480 V, Constant Torque or Variable Torque Low Noise	9"
30–50 hp, 480 V, Variable Torque	
500 VA Customer Capacity on Drive's 120 V Control Transformer	
50–200 hp, 480 V, Constant Torque or Variable Torque Low Noise	
60–200 hp, 480 V, Variable Torque	
750 VA Customer Capacity on Drive's 120 V Control Transformer	0"
250–400 hp, 480 V, All Types	
Dynamic Braking	
3/4–15 hp, Variable Torque or 3/4–10 hp Constant Torque/Variable Torque Low Noise	6"
20–50 hp, Variable Torque or 15–40 hp Constant Torque/Variable Torque Low Noise	9"
Option Boards	
I/O Extension Module, 24 Vdc	
I/O Extension Module, 115 Vac	
Unit Extenders	
Control and Timing Relays	
Auto Start Relay for "auto" mode	
1.5–30 second start delay for "auto" mode	
Unwired D-line relay with 2N.O./2N.C. contacts	0"
Unwired D-line relay with 2N.O./2N.C. untimed contacts and 1N.O./1N.C. 10–180 sec. off delay contacts.	
Unwired D-line relay with 2N.O./2N.C. untimed contacts and 1N.O./1N.C. 10–180 sec. on delay contacts.	
Miscellaneous Options	
3–15 PSI Pneumatic Follower	
24 Vdc Power Supply	
Omit Control Station Plate	
Power Contactor Control Circuits	
3 Wire Control for Bypass	
Bypass Duty Cycle Timer	
Auto-Bypass	0"
Power Isolator Control	
Elapsed Time Meter	

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